COMMISSION OF THE EUROPEAN COMMUNITIES



Brussels, 2.4.2007 SEC(2007) 474

### COMMISSION STAFF WORKING DOCUMENT

### 21<sup>st</sup> REPORT OF THE SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES

(Second Plenary Meeting)

Brussels, 7-11 November 2005

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area.

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### **1 INTRODUCTION**

STECF met on the premises of DG FISH, Rue Joseph II, 99 in Brussels from 7 to 11 November 2005.

The Chairman of the STECF, Dr John Casey, opened the plenary session at 1400h.

Mr John Farnell Director, DG FISH, welcomed participants, offering his apologies for the less than satisfactory meeting facilities. He indicated that the option of holding future Plenary sessions at the Secretariat headquarters in Ispra, Italy would be investigated and expressed his good wishes for a successful meeting.

The terms of reference for the meeting were reviewed and the meeting agenda agreed. The session was managed through alternation of Plenary and working group meetings.

The meeting closed at 1345h on 11 November.

### **2 LIST OF PARTICIPANTS**

### Members of the STECF:

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### **3 TERMS OF REFERENCE**

### 3.1 INFORMATION FROM THE COMMISSION AND 2006 PLANNING

The Commission will inform STECF of progress on issues concerning the framework for scientific advice in 2006 and afterwards. The issues concerned will include:

- 1. Nomination of new STECF (new Regulation)
- 2. Mandate for the STECF November 2005 November 2006: tasks, organisation, subgroup coordinators, planning 2005/2006.
- Data collection. Council Regulation (EC) 1543/2000: Written procedure (by correspondence) for adoption of the forthcoming SGRN report (28 November 2 December) addressing MS non conformities and derogations for 2006 national programs.
- 4. Rules of procedures of the STECF

### **3.2 FISHERIES CONSERVATION**

### 3.2.1 Review the scientific advice on stocks of Community interest

Based on the report prepared during the SGRST-SGECA meeting of October 24-28, STECF should update the stock status report prepared November 2004 using the most recent scientific information. The STECF should take into account the most recent scientific advice from the ICES-ACFM and scientific committees of relevant Regional Fisheries Organizations. Furthermore STECF is requested to address the following questions on specific stocks:

### 3.2.2 Specific requests from the Commission on stocks of Community Interest

### 3.2.2.1 Fishing effort for Cancer pagurus and Maja squinado stocks

Evaluate whether the fishing effort regime as established in Council Regulations 1954/2003 and 1415/2004 is adequate for sustainable exploitation of edible crab (*Cancer pagurus*) and spider crab (*Maja squinado*) stocks as targeted by the Irish fleet.

### 3.2.2.2 Greenland Halibut in V, XII and XIV

Evaluate the soundness of the assessment for Greenland halibut in V , XII and XIV and the appropriateness of the management plan, agreed at the last December Council, which foresee a large effort reduction of 66% as well as a consequent reduction of the EU quota with respect to the year 2004. The plan foresees gradual annual reductions of the quota rather one instant reduction in order to reach the ICES advised effort level by 2008.

### 3.2.2.3 Nephrops stocks

Identify which harvest rates for stocks of Nephrops are consistent with exploiting the stocks at maximum sustainable yields (or suitable proxy) and, if relevant economic information is available, STECF should also identify which harvest rates are consistent with exploiting the stocks at maximum economic yield. This request applies to all stocks of *Nephrops* where ICES provided advice in the form of a table of harvest rates in October 2005.

### 3.2.2.4 Anchovy in the Bay of Biscay

Identify which harvest control rules for Bay of Biscay anchovy need to be developed for 2006 in the light of the ICES advice that no fishing shall be undertaken until a strong year class recruits to the exploited stock

### 3.2.2.5 Haddock in the North Sea (ICES Sub-area IV and Division IIIa)

Evaluate whether there are inconsistencies in the ICES catch forecast table for haddock in IV and IIIa and, if the case, produce another one.

### 3.2.2.6 Haddock in the North Sea (ICES Sub-area IV and Division IIIa)

The forecast for this stock are based on historical levels of industrial by-catches, but there will be no industrial fisheries in 2006. STECF is asked to make forecast calculations with a range of levels of industrial by-catch (to cover the possibility that the industrial fisheries will be reopened mid year).

### 3.2.2.7 Anglerfish in ICES Divisions VIIIc and IXa

Assess appropriateness of model used by ICES to assess anglerfish in VIIIc and IXa. Fishing mortality on anglerfish in VIIIc and IXa is estimated to have more than doubled since 2002. The total catch for these species (*L. piscatorius* and *L. budegassa*) increased during this period from 1802 tonnes to 4000 tonnes. Most of this increase is of L piscatorius in Division VIIIc However, information on the effort of these fleets does not indicate an increase, and F in related species such as southern hake or megrims is stable over this period. Survey biomass indices for this period show an increase of 56% (Spanish survey) or 167% (Portuguese survey), although the latter must be looked at with caution because of the small quantities of anglers caught during the survey. Commercial CPUEs of the Santander fleet increased by 97% during this period. Similarly, those of trawlers from La Coruña increased by 60% (see SDWG report). With this information, does STECF think that the ASPIC model used by ICES to assess this stock is appropriate for exploring trends in SSB and F?

### 3.2.3 propose sustainable exploitation rules for Bay of Biscay Sole, Celtic Sea Cod and Anglerfish in ICES Divisions VIIIc and IXa

STECF should deliver an opinion based on the work done by subgroup SGMOS-05-01 (26-30 September, 2005) which proposed targets for sustainable exploitation, and harvesting rules for catch and/or fishing effort limits for Bay of Biscay Sole, Celtic Sea Cod and Anglerfish in ICES Divisions VIIIc and IXa.

### 3.2.4 Identify demersal fisheries where mixed species are caught in Community waters and adjacent areas and estimate their catches for 2006

STECF should deliver an opinion based on the work done by subgroup SGRST-05-02 (17-21 October, 2005) which compiled recent data on demersal mixed fisheries, identified stocks, areas and fleets where there are significant mixed catches and estimated catches for 2006.

### 3.2.5 Assess the effectiveness of the cod recovery plan

STECF should deliver an opinion based on the conclusions of subgroup meetings SGRST-05-01 (13-17 June 2005) and SGRST-05-4 (19-21 September 2005) which aimed to (a) identify the location and season of the most important fishable concentrations of cod in the North Sea, Skagerrak, eastern Channel, Kattegat, Baltic Sea, west of Scotland, Celtic Sea and the Irish Sea (b) review the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004) (c) evaluate systems feasible for

management of fishing effort in the context of a multi-annual management plan for the cod stocks in the Baltic Sea.

### 3.2.6 Assess harvest control rule for sand eel in North Sea and Skagerrak and advise on actions for 2006 including level of sentinel fishing

STECF should deliver an opinion based on the outcome of the ad-hoc working group ADHOC-05-03 which aimed to (a) evaluate whether the current HCR for sand eel in the North Sea and Skagerrak are suitable or need to be changed (b) determine what actions shall be envisaged for 2006 on the basis of the ACFM advice and considering that Council Regulation n.1147/2005 of July 2005 has prohibited sand eel fishing until the end of 2005 on the basis of the agreed HCR; (c) assess what level of monitoring fishing (sentinel fishing) shall be allowed in 2006 with a view of monitoring the 2005 recruitment strength in case that a 0 TAC or a very low level of fishing effort need to be established for 2006.

### 3.2.7 Fishing effort for vessels in the context of the recovery of certain stocks

STECF is requested to comment on the proposal from the Scottish Fisheries Federation forwarded from the North Sea Regional Advisory Council (NSRAC) for improving the basis of target species (Nephrops) management and enhancing selectivity in the finfish by-catch in small mesh fisheries in the Northern North Sea, evaluating where possible the biological and economic effects of the measures from FRS (restricted web-site)

### 3.2.8 Future position of beam trawlers in management of demersal North Sea fishing – Proposal For Amendment Of Annex IVa Of The EU TAC And Quota Regulation 27/2005

STECF should check, consider and give an opinion on the request from the Dutch fishermen forwarded by the North Sea RAC to remove beam trawlers with V nets must from Annex IVa of the 2005 TAC (Council Regulation 27/2005 of 22 December 2004) and to regulate the effort of this fleet within the scope of a plaice management plan.

### 3.2.9 Proposal for amendment of Annex IVa of the EU TAC and quota regulation 27/2005 for fisheries with demersal trawls other than beam trawls

STECF should check, consider and give an opinion on the request from the Dutch fishermen forwarded by the North Sea RAC to (1) restructure days at sea in Annex IVa for demersal trawls other than beam trawls and (2) split the days-at-sea, now defined as consecutive period of 24 hours, in two 12 hour periods.

### **3.3 FISHERIES ECONOMICS**

### 3.3.1 propose a way forward for bio-economic modelling in the EU

The recent subgroup meeting SGECA-SGRST-05-01, assessed bio-economic models, their data requirements and ongoing projects. Based on the outcome of this meeting STECF should propose how better bio-economic advice can be delivered in the future.

### 3.3.2 assess the economic impact on European fleets of the latest ICES-ACFM advice

STECF should deliver an opinion based on the outcome of the EIAA model calculations made during the SGRST-SGECA meeting of October 24-28

### 3.3.3 Assess Member States' progress in achieving a sustainable balance between fishing capacity and fishing opportunities.

The Commission, on the basis of the data in the Community Fleet Register and information contained in the Member States' annual reports, has prepared a *summary annual report* and presented it to the Scientific Technical and Economic Committee for Fisheries on 29 July 2005. STECF should provide its opinion on this report.

### 3.4 ECOSYSTEM APPROACH

### 3.4.1 Review evidence on by-catch of sea turtles in EU long line fisheries.

STECF should deliver an opinion based on the work done by subgroup SGRST-SGFEN-05-01 which (a) summarised EU long line fisheries, (b) assessed the known by-catches of turtles (c) reviewed data from national rescue centres and (d) assessed knowledge on effectiveness of mitigation measures.

The subgroup identified severe shortage of data from the Indian Ocean, Pacific Ocean, but also in many Atlantic areas. The subgroup recommended more research into mitigation techniques that addressed the whole by-catch problem in order to avoid endorsing techniques that shift the problem from one species to another.

### 3.4.2 Revision of the Data Collection Regulation to take into account the ecosystem approach

STECF should deliver an opinion based on the work done by subgroup SGRN-05-03 which recommended the data could be collected to provide information on (a) the spatial and temporal distribution of different fishing activities (b) trends in fish assemblages. (c) impact of fishing on species that are intentionally exploited and on unintended by catch (d) genetic erosion of commercial wild stocks.

The subgroup recommended collecting data that would support the production of pressure and state indicators. These included making VMS data available for scientists and extending the data collected in surveys. The focus is on impact of fisheries on environment rather than the other way round (because we do not have models to include environmental data)

## 4 INFORMATION FROM THE COMMISSION AND 2006 PLANNING

The Commission will inform STECF of progress on issues concerning the framework for scientific advice in 2006 and afterwards. The issues concerned will include:

### 4.1 NOMINATION OF NEW STECF

The Commission drew attention to Commission decision of 26 August 2005 establishing a Scientific, Technical and Economic Committee for Fisheries (2005/630/EC). Members were informed that the new Committee to be established under the decision should be appointed before the plenary meeting of April 2006. The term of office of the present Committee will continue until the new Committee is appointed.

# 4.2 MANDATE FOR THE STECF NOVEMBER 2005 – NOVEMBER 2006: TASKS, ORGANISATION, SUBGROUP COORDINATORS, PLANNING 2005/2006.

Given the extensive potential list of meetings for 2006 and the demanding agenda for the current meeting, the Committee took the decision to defer detailed planning of meetings for 2006. It was decided that a meeting of the STECF Bureau should be convened at a mutually convenient date and venue in December 2006 to address detailed planning of Sub-group meetings for 2006.

The date of the next plenary meeting was not fixed but it was agreed it should take place either during the week beginning 27 March, 2006 or 3 April 2006. The exact dates are to be decided by the STECF Bureau.

### 4.3 WRITTEN PROCEDURE (BY CORRESPONDENCE) FOR ADOPTION OF THE FORTHCOMING SGRN REPORT (28 NOVEMBER – 2 DECEMBER ) ADDRESSING MS NON CONFORMITIES AND DEROGATIONS FOR 2006 NATIONAL PROGRAMS.

The SGRN Sub-group will meet as follows:

Date:	28 November – 2 December 2005
Venue:	Brussels
Chair:	Frank Redant

The Chairman of the Sub-group should send the report of the Sub-group to the Secretariat by 6 December 2005. The Secretariat should immediately place the Report on the meeting web site and inform STECF members that it is ready for review. Masimilliano Cardinale will assume responsibility for drafting the STECF comments and recommendations and forwarding to the Secretariat by 8 December 2005. The STECF comments and recommendations should be finalised by Masimilliano Cardinale in the light of suggestions for amendments from members of STECF. The final response should be sent to the Secretariat by 1200h GMT on 13 December 2005.

### 4.4 RULES OF PROCEDURES OF THE STECF

The Commission drew attention to a draft document drawn up by the Commission containing proposed rules of procedure for STECF. The Committee was informed that the document will be circulated to the existing committee for comment by correspondence and that new rules of procedure should be adopted by the STECF at its plenary meeting in March/April 2006.

### 4.5 IMPROVEMENT OF SCIENTIFIC AND TECHNICAL ADVICE FOR THE NON-EU FISHERIES

A. Di Natale informed STECF that he had received an invitation from DG Fishery (FISH/B/1/DC/ca/D2005) to represent STECF at an International Seminar organised by the EC in Mauritius, on the "Improvement of scientific and technical advice for the non-EU fisheries". STECF welcome this invitation, considering it a further step forward in the integration of the STECF in the work of DG FISH and underlining the role of the STECF within the CFP.

### **5 FISHERIES CONSERVATION**

### 5.1 REVIEW THE SCIENTIFIC ADVICE ON STOCKS OF COMMUNITY INTEREST

The STECF review of stocks of Community interest is published in the report produced in the meeting SGECA-SGRST-05-02 of 24-28 October, 2006. This review presents summary information on the state of stocks and management advice for stocks of Community interest throughout the world including those in Third Countries and international waters. In undertaking the review, STECF has consulted the most recent reports on stock assessments and advice from appropriate scientific advisory bodies or other readily available literature, and has attempted to summarise it in a common format. The review is partially incomplete, since in some cases, appropriate information was not readily available to the group. For some stocks the review remains unchanged from the Review of advice for 2004 (SEC(2004)372), since no new information on the status of or advice for such stocks was available at the time the review took place. This does not mean that no such information exists; merely that STECF did not have access to it. A comment to this effect is included in the relevant stock sections. Nevertheless, the report provides summary assessment and management advice on about 300 stocks of interest to the Community.

STECF notes that the term 'stock' in some cases, may not reflect a likely biological unit, but rather a convenient management unit. In specific cases STECF has drawn attention to this fact. STECF also is of the opinion that, as far as possible, management areas should coincide with stock assessment areas.

For each stock, a summary of the following information is provided:

### **STOCK:** [Species name, scientific name], [management area]

**FISHERIES:** fleets prosecuting the stock, management body in charge, economic importance in relation to other fisheries, historical development of the fishery, potential of the stock in relation to reference points or historical catches, current catch (EU fleets' total), any other pertinent information.

**SOURCE OF MANAGEMENT ADVICE**: reference to the management advisory body.

MANAGEMENT AGREEMENT: where these exist.

**PRECAUTIONARY REFERENCE POINTS:** where these have been proposed.

**STOCK STATUS:** Reference points, current stock status in relation to these. STECF has included precautionary reference point wherever these are available.

**RELEVANT MANAGEMENT ADVICE:** summary of advice.

**STECF COMMENTS:** Any comments STECF thinks worthy of mention, including errors, omissions or disagreement with assessments or advice.

STECF notes that following the introduction of mixed fishery advice in 2003, ICES began providing overviews of its advice for groups of stocks commencing in 2004. Such advice is summarised in section 16 of this report. In addition, the advice in relation to single species exploitation boundaries and the associated terminology has also been modified. For most stocks, the single species advice on the state of the stock is formulated under two main headings:

- Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects.
- Exploitation boundaries in relation to precautionary limits

For those stocks for which management plans have been agreed, ICES has also provided advice under the heading

#### • Exploitation boundaries in relation to existing management plans.

The ICES advice also contains other information that may be important to the formulation of management proposals and agreements. However, in this report, STECF provides only a summary of the pertinent points in the ICES advice and suggests that the full ICES advice, together with any comments from STECF are taken into account before any management decisions are taken.

Furthermore, brief overviews of the fisheries in the Mediterranean and Southwest Atlantic are also included in the report in Section 17.

A list of reports and publications consulted is given at the end of the document. STECF recognises that in future the format of the stock review publication may evolve, taking into account comments from users of the publication.

The STECF review of scientific advice was drafted by the STECF Sub-group on Resource Status (SGRST, Chair, J. Casey) during its joint meeting with the Sub-group on Economic Assessment (SGECA) of 24 - 28 October 2005, and subsequently finalised and endorsed at the 21st STECF Plenary meeting (7 – 11 November 2005).

### 5.1.1 STECF Statement on the Johannesburg Declaration and the CFP

The EU has committed to the outcomes of the World Summit on Sustainable Development at Johannesburg (2nd to 4th September 2002). STECF considers, that the Johannesburg Declaration requires agreement on new operational management objectives within the CFP and as a consequence, impacts on the advisory criteria of STECF, ICES and other advisory bodies.

Paragraph 31 (a) of the Declaration defines that stocks should be recovered to levels that can produce maximum sustainable yields (MSY) by 2015. This objective was established in the "Rio Declaration" of 1992, but without an agreed time schedule of reaching the objective.

The Johannesburg plan of implementation is a commitment to rebuild individual stocks to the states at which they can produce maximum sustainable yields. This means that each fish resource should be able to produce maximum sustainable yields within the constraints of the ecosystem that it inhabits. This excludes the possibility of attempting to manipulate ecosystem structure by over-fishing some species in order to improve the yields of others.

The productive capacity of the seas and oceans is limited and it may not be possible to achieve the maximum sustainable yield that would be predicted starting from current conditions for all stocks in an ecosystem simultaneously - mainly because species compete with each other for resources. Therefore, management measures must be found that are robust to prediction uncertainty.

It has been stressed, that the practical problems of estimating the biomass required to reach MSY are so great, that biomass should not be used as an operational aim, even though it is used as the aim in the Declaration. The problems are related to the uncertain stock-recruit information and to the variability of the aquatic environment. As a result, it has been suggested that instead of using the uncertain Bmsy, the use of Fmsy would be a less uncertain management goal. STECF agrees that Fmsy can be used instead of Bmsy, if there is no useful S/R information available.

In order to reach the goal of Johannesburg Declaration, STECF considers that the biomasses of fish stocks in year 2015 should consist of year classes which have been recruited to the stock as a result of applying  $F_{msy}$  earlier on in the management. Then provided a stock is in a state where it would be expected to experience normal recruitment (i.e. is above Blim) and if the fishery (including discards) on a stocks is only substantial in terms of total fishing mortality or overall biomass for age groups 2 – 7 then  $F_{msy}$  must be achieved 6 years (number of significant age groups) before the target year of 2015 in order to reach the political aim. This implies a need for an additional element in management current plans to reach Fmsy in the required time period. For the example above, this would mean an operational objective to reach Fmsy by 2009 at the latest.

STECF **recommends** that a management objective satisfying the above criteria be set for each stock.

STECF further **recommends** that  $F_{msy}$  or an agreed proxy should routinely be included in stock status reports and advice.

### 5.2 SPECIFIC REQUESTS FROM THE COMMISSION ON STOCKS OF COMMUNITY INTEREST

### 5.2.1 Fishing effort for Cancer pagurus and Maja squinado stocks

STECF was asked the following:

*Evaluate whether the fishing effort regime as established in Council Regulations* 1954/2003 and 1415/2004 is adequate for sustainable exploitation of edible crab (*Cancer pagurus*) and spider crab (*Maja squinado*) stocks as targeted by the Irish fleet.

### 5.2.1.1 background

As a background for the evaluation the STECF had at its disposal a document requesting increased effort provided by Ireland containing an overview of the development of the Irish fishery (IR 2005a), a response from the Commission (COMM 2005), an addendum to the Irish Govt. request (IR 2005b), a resource evaluation report (Tully et al. 2005) and recent ICES crab study group reports (ICES 2003; 2004; 2005).

As the landings into Ireland of spider crab from area VI are negligible, the biological data submitted relates only to edible crab (*Cancer pagurus*). STECF notes that catches of spider crab in ICES area VI are generally negligible as the species reaches the northern limits of its distribution on the mid west coast of Ireland (ICES area VII). STECF notes, however, that comments regarding the current fishing effort regulation also apply to fisheries for this species.

### 5.2.1.2 Status of edible crab stock in Area VI

The LPUE series provided to STECF show a declining trend during 1990-1994 (the development phase of the offshore fishery) followed by a period of apparent stability in the mid 1990s and more recently a further decline in LPUE. Declining LPUE appears to coincide with periods of expansion of capacity and effort in the fishery. In addition, available landings and effort data indicate that recent high levels of effort have realised only small increases in landings and that LPUE has declined linearly with increasing effort.

STECF considers that the observed decline in LPUE indicates a decline in abundance.

STECF further notes, however, that 1) that there appears to be no recent change in the average size of crabs in the landings and 2) that the cumulative size distribution of landings indicates that landing of crabs does not occur until they are significantly larger that the minimum landing size (Minimum legal size: 130mm, landing size is generally (>95%) >150 mm). Maturity ogives presented indicate that 50% of crabs are mature at 120mm and all crabs by 130mm. This implies that a significant proportion are able to spawn before capture. However, these figures relate to combined sex data: size at 50% maturity for female crabs in this fishery varies from 133 to 138mm dependent on area (ICES 2004).

### 5.2.1.3 Effort trends in the fishery for edible crab in Sub-area VI

STECF notes that deployed effort in the Irish northwest crab fishery (ICES area VI and part of area VII) exceeded 775,000 kW days in 2003 – a figure smaller than the total allowed effort provided for in Council Regulation 2027 of 1995. The nominal effort limit set for Ireland by Regulation 1415/2004 is 465,000 kW days, based on the average effort deployed from 1998–2002.

Effort, in terms of pot hauls, has increased six-fold over the period 1992-2004 (for the analysed group of offshore vessels). Effort (pot hauls) increased rapidly in the period 1990-1994, was relatively stable from 1994-2000 and has since increased rapidly to the series maximum in 2004.

### 5.2.1.4 Appropriateness of current effort regulations

STECF notes that the introduction of the 2004 kW days regulations actually provides for a marked increase of the total allowable effort compared to previously observed levels. Whilst STECF was not provided with information on the level of uptake, it is believed that some Member States do not fully utilise their effort allocations. There is therefore a considerable amount of latent capacity (in nominal effort) available.

The increase in numbers of pots hauled in the presented data since the implementation of the 2004 effort regulations also demonstrates that these regulations have not restricted effective effort.

The combination of latent capacity and the ability of the fleet to increase effective effort by deploying more gear render the effort regulations ineffective.

#### 5.2.1.5 Conclusions

STECF notes a decline in abundance, current high levels of effective effort and the inability of current regulations to effectively control effort in this fishery. STECF therefore concludes that the fishing effort regime, as established in Council Regulations 1954/2003 and 1415/2004, is inadequate for sustainable exploitation of edible crab (*Cancer pagurus*) stocks.

STECF suggests that effective effort would be better regulated by restricting the number of pots and number of pot hauls in the fishery. STECF considers that regulation of effective effort should apply to all vessels prosecuting this fishery, rather than just those >15m.

During the mid 1990s LPUE was sustained at a stable level. STECF suggests that the average annual effective effort as proposed above, over this period (which was not available to STECF due to lack of data from some fleets) could be used as an appropriate level of effort that may sustain the fishery.

### 5.2.1.6 References

- COMM (2005). Response of the Commission to a request by Ireland for increased effort for edible crab & spider crab in ICES area VI. Dated 12<sup>th</sup> April 2005.
- ICES (2003). The Report of the ICES Study Group on the Biology and Life History of Crabs. ICES CM 2003/G:11.
- ICES (2004). The Report of the ICES Study Group on the Biology and Life History of Crabs. ICES CM 2004/G:13.
- ICES (2005). The Report of the ICES Study Group on the Biology and Life History of Crabs. ICES CM 2005/G:10.
- IR (2005a). Request for increased effort for edible crab & spider crab in ICES area VI. Submitted 16<sup>th</sup> March 2005.
- IR (2005b). Addendum to a request for increased effort for edible crab & spider crab in ICES area VI. Submitted 2<sup>nd</sup> September 2005.
- Tully, O., Robinson, M., Cosgrove, R., O Keeffe, E., Doyle, O. & Lehane, B. (2005). The Brown Crab (Cancer pagurus L.) fishery: Analysis of the resource in 2004-2005. Report compiled for the Crab Advisory Group, Ireland.

### 5.2.2 Greenland Halibut in V, XII and XIV

STECF was asked the following:

Evaluate the soundness of the assessment for Greenland halibut in V, XII and XIV and the appropriateness of the management plan, agreed at the last December Council, which foresee a large effort reduction of 66% as well as a consequent reduction of the EU quota with respect to the year 2004. The plan foresees gradual annual reductions of the quota rather one instant reduction in order to reach the ICES advised effort level by 2008.

### 5.2.2.1 evaluation of the assessment for Greenland halibut in Sub-areas V, Xii and XIV

STECF notes that the genetic and productivity structure of the stock is weakly defined within the management areas V, VI, XII and XIV. Moreover, there are no precautionary reference points defined and the assessment is only based on area-

disaggregated stock indices although none of those indices covers the entire distribution of Greenland halibut in these areas.

5.2.2.1.1 Surveys indices:

- Vb no information
- Va drastic drop in abundance for all size classes
- XIVb insignificant changes or slight decrease compared to 1998-2000.

5.2.2.1.2 Commercial CPUE indices:

- Vb recently stable but low compared to 1991-1993.
- Va recently sharply decreased and at historical low level.
- XIVb no trend recognisable.

The ACFM indicated a general decline in stock abundance for the whole area. However, based on the trends in the indices given above, there is a recent sharp decline in stock size indicated in Va both from surveys and commercial CPUE, while the stock appears stable in area XIVb. The status in Vb, VI and XII is uncertain but catches from theses areas represent only a minor component of the international catch. The observed decrease in abundance in Va is probably the result of increased fishing effort and landings since the late 1990s. In this area the largest part of the catch is usually taken.

STECF concludes that the stock abundance in all management areas V, VI, XII and XIV as a whole remains uncertain, although there are indications of substantial local depletion in some of the management areas.

### 5.2.2.2 Appropriateness of the management plan

STECF is unaware of any management plan for Greenland halibut in V, VI, XII and XIV but notes that any management plan needs to be agreed and implemented by the coastal states of Greenland, Iceland and Faeroes Islands.

The ACFM advice for 2006 applies to all management areas (i.e. V, VI, XII and XIV) and recommends a TAC of less than 15,000 t which is considered to be consistent with an effort reduction of 2/3 compared to the level estimated for 2003.

STECF notes that there is no analytical basis for proposing a TAC for 2006 of less than 15000 t. for all areas combined. However, taking into account the available information on the state of the stock.

In the absence of an area based management plan the area STECF **recommends** that the fishing mortality of Greenland halibut should be reduced in all management areas (i.e. V, VI, XII and XIV). STECF **recommends** a stronger effort reduction in those areas where Greenland halibut shows a larger decline in stock size would be preferred. STECF **recommends** that if an area based management plan with higher effort reduction in area Va be agreed, this is expected to decrease the probability of local deletion and contribute positively to improvements in the state of the stock.

There is no reliable basis to give unequivocal advice on a catch level for the whole area. The CPUE data from area Va suggests that previously a catch level of 11,000 was sufficiently low to allow CPUE to increase in subsequent years. In the absense of any better information the choice of this effort / catch level for area Va would not be inappropriate. For area XIVb the current catch level of is 7,000 t (average of last 6 years treating the final year as uncertain). CPUE series for this area is relatively stable over this period despite fluctuation in catch. There is no evidence to suggest that 7,000 t is an inappropriate level for catch in this area. If these amounts are to be allocated, it must be in the context of an area management agreement that ensures that these are the maximum amount taken in each area. In the absence of an area based management agreement the Va reduction rate should be applied across all areas (this implies 16,500 t for all areas). STECF recommends that stock monitoring data be collected for any significant fishery and stock evaluation should be carried out possibly through coordination of existing surveys.

### 5.2.3 Nephrops stocks

STECF was asked the following:

Identify which harvest rates for stocks of Nephrops are consistent with exploiting the stocks at maximum sustainable yields (or suitable proxy) and, if relevant economic information is available, STECF should also identify which harvest rates are consistent with exploiting the stocks at maximum economic yield. This request applies to all stocks of Nephrops where ICES provided advice in the form of a table of harvest rates in October 2005.

### 5.2.3.1 Background

ICES advice on the status of *Nephrops* stocks has been based since 1992 on XSA assessments using sliced length composition data. In recent years, however, the quality of official landings data has been called into question leading to doubts about the reliability of both the TAC advice and the analytical assessments conducted by ICES. In its 2005 analysis, ICES did not include assessments based on landings data – in particular because of unreliability and uncertainties in the suitability of the XSA method for *Nephrops*. ICES did, however, provide information on the state of some stocks using fishery independent data; specifically, underwater television surveys. These avoid the problem of variable catch rates in trawls surveys that arise from the emergence behaviour of *Nephrops*. ICES further showed that for a number of *Nephrops* stocks (in the North Sea and West of Scotland) current levels of exploitation appear sustainable but advised against any increase in effort. ICES/ACFM also noted the need for mandatory collection of accurate data to assist in the future assessment process.

Based on the available fishery independent data (underwater television surveys), ICES went on to advice on potential catch levels for 2006; this advice was obtained by applying a range of possible harvest ratios (HR) to the TV abundance data. However, in the absence of a more suitable approach, these harvest ratios were based on a comparison with reported landings. Given that the quality of landings and other official data is questioned in the ICES report, the appropriateness of harvest ratios based entirely on these data is problematic.

### 5.2.3.2 STECF comments

STECF considered an alternative approach, based on yield per recruit analysis, to determine more appropriate harvest ratios, (see ICES Nephrops assessment WG Report 2004). Although the use of length cohort analysis (LCA) or other similar techniques have shortfalls, the concerns mainly relate to estimating the current state of exploitation, and not the overall shape of the yield per recruit curve, and, consequently, reference points based on that curve. Yield per recruit analysis provides estimates of a number of reference points including F<sub>max</sub> (a proxy for MSY) and the more cautious F0.1. STECF noted both that  $F_{max}$  is more difficult to estimate than F0.1 and that  $F_{msy}$  is normally expected to be at or below Fmax but also depends also on stock recruit relationships that are unknown for these stocks. Given these uncertainties STECF is of the opinion that F0.1 is an appropriate fishing mortality to recommend for exploitation: this would be consistent with the precautionary approach. Data from six major Nephrops fisheries (in two groups of 3 stocks, in the North Sea and to the West of Scotland) and for which extensive data exist, were considered and the results,  $F_{max}$ , F0.1 and the corresponding harvest ratios (HR), are shown in the Table 5-1

	1 0			
Stock	$F_{max}$	HR%	$F_{0.1}$	HR%
Group 1:	West of So	cotland sto	cks.	
North Minch	0.40	33.1%	0.23	20.5%
South Minch	0.55	42.4%	0.23	20.7%
Clyde	0.36	30.0%	0.23	20.4%
Mean		35.2%		20.5%
Group	2: North	Sea stocks	•	
Fladen	0.39	32.4%	0.21	19.2%
Forth	0.36	30.5%	0.22	19.4%
Moray Firth	0.45	36.1%	0.24	21.0%
Mean		33.0%		19.9%

Table 5-1  $F_{max}$ , F0.1 and the corresponding harvest ratios (HR)

The (combined sex) yield per recruit curves for these two groups are also shown. Both the yield per recruit curves and the estimated reference points generated from the curves are relatively consistent between areas. This is not unexpected given the similar growth and natural mortality and selection patterns in the fisheries.

- $F_{max}$  varies between 0.36 and 0.55, and exploitation at this level would imply an average harvest ratio between 33 35%.
- A more precautionary level, F0.1 appears particularly consistent, ranging from 0.21 to 0.24, equating to a harvest rate of approximately 20%.



Figure 5-1 Combined sex relative yield per recruit curve for West of Scotland Nephrops stocks, based on LCA.



Figure 5-2 Combined sex relative yield per recruit curve for Northern North Sea Nephrops stocks, based on LCA.

5.2.3.2.1 TV survey abundance and use of the harvest ratios to provide catch advice.

Based on the available fishery independent data (underwater television surveys), ICES has reported that the six *Nephrops* stocks considered here are stable or in some cases increasing in abundance. STECF considered trends in TV abundance and trends in mean size in the landings and catch and concurred with the ICES conclusion. Increases in abundance were particularly evident for the West of Scotland *Nephrops* stocks. Mean size of the larger component of the landings are generally stable while in the small component there is more fluctuation, reflecting recruitment variability. The stable mean size of the larger components provides a further indicator of the healthy nature of these stocks.

### 5.2.3.3 Economic Aspects

When the production (income) and cost curves are not known in detail it is not possible to calculate the maximum economic yield (MEY). When the maximum sustainable yield (MSY) (or other biologically based exploitation rate) has been established, it is possible to determine the appropriate maximum number of vessels (capacity) taking into account the days at sea, and the harvest per day at this exploitation rate. When this level is achieved in practice, a step by step procedure should start with cuts in capacity in order to explore the shape of the production curve as the maximum economic yield is more conservative than the MSY. The commission should investigate this further through a WG with appropriate TOR.

### 5.2.3.4 STECF Conclusions

The results given here, which provide guidance for the general exploitation targets for *Nephrops* functional units in VIa (North Minch FU 11, South Minch FU 12, Clyde FU 13) and in the North Sea (Fladen FU 7, Forth FU 8, Moray Firth FU 9). STECT considers that implementation of these exploitation rates needs to take the following points into consideration.

• There is evidence of unreported catch (from ICES reports and an EU project 99/OJ C122) and therefore current catches are already higher than reported

landings. As a result current exploitation rates as estimated by landings data and reported by ICES are almost certainly underestimates.

- Management is currently carried out on a management area basis, within which are several Functional Unit based fisheries. If the object is to manage these areas in accordance with an F0.1 objective there is a need to ensure that appropriate harvest rations are maintained in each of the functional units. i.e. separate *Nephrops* stocks must be managed separately.
- Some of the "*Nephrops*" fisheries make an important contribution to mortality on depleted stocks. Therefore there is a need for effort management and mandatory by-catch mitigation methods that are consistent with recovery plans and management plans for other stocks that are caught in fisheries for *Nephrops*.

Taken together these points lead to the following STECF conclusions for exploitation of *Nephrops*.

STECF considers that  $F_{0.1}$  is a suitable sustainable exploitation target for *Nephrops* Functional Units in VIa (North Minch FU 11, South Minch FU 12, Clyde FU 13) and in the North Sea (Fladen FU 7, Forth FU 8, Moray Firth FU 9) and that is best achieved through a functional unit based effort management regime with accompanying by-catch mitigation measures. Any such regime should be consistent with recovery plans and management plans for other stocks that are caught together with *Nephrops*.

STECF notes that exploiting *Nephrops* at F0.1 implies an approximate harvest rate corresponding to a catch/biomass ratio of about 20%. However, given the concerns regarding unreported catch, the harvest rates for the above *Nephrops* Functional Units presented in the ICES advice, which are based on the ratio of reported landings to the estimated biomasses from underwater TV surveys, are almost certainly underestimated.

Taking into account the requirements of recovery plans and management plans for other stocks that are caught in fisheries that exploit *Nephrops*, together with the uncertainty regarding current harvest rates, STECF makes the following two recommendations:

- 1. STECF **recommends** that there should be no increase in the exploitation rate on *Nephrops* Functional Units in VIa (North Minch FU 11, South Minch FU 12, Clyde FU 13) and in the North Sea (Fladen FU 7, Forth FU 8, Moray Firth FU 9). STECF stresses that this means that *Nephrops* catches i.e. landings and discards, and effort in these fisheries for *Nephrops* should be capped at the recent (2004) level or reduced in line with the requirements of recovery plans and management plans for other stocks that are caught together with *Nephrops* from these Functional Units.
- 2. STECF **recommends** that without a move to a functional unit based effort management regime with accompanying by-catch mitigation measures there should be no move to  $F_{0.1}$  as a target.
- Marrs, S.J., Tuck, I.D., Arneri, E., La Mesa, M., Atkinson, R.J.A., Ward, B., & Santojanni. A. 2002. Technical Improvements in the assessment of Scottish *Nephrops* and Adriatic clam fisheries.(99/077 Study Project in support of the Common Fisheries Policy call for proposals 99/OJ C122)
- Report of the Working Group on *Nephrops* Stocks 28–01 April 2004 Lisbon, Portugal ICES CM 2004/ACFM:19

### 5.2.4 Anchovy in the Bay of Biscay

STECF was asked the following:

Identify which harvest control rules for Bay of Biscay anchovy need to be developed for 2006 in the light of the ICES advice that no fishing shall be undertaken until a strong year class recruits to the exploited stock.

### 5.2.4.1 Background

### 5.2.4.1.1 ICES advice in 2005

Based on the most recent estimates of SSB, ICES classifies the anchovy stock in Sub-Area VIII (Bay of Biscay) as suffering from reduced reproductive capacity. SSB is estimated to be well below  $\mathbf{B}_{lim}$ . The stock in 2005 is the lowest in the time series. Low recruitment since 2001 and almost complete recruitment failure in 2004 are the primary causes of the stock collapse. This led to the closure of the fishery in July 2005. ICES recommends that the fishery should remain closed and should, at the earliest, be considered for opening if the acoustic and egg surveys in May-June 2006 demonstrate a strong 2005 year-class.

### 5.2.4.1.2 STECF advice in 2005

STECF agrees with the ICES' advice and reiterates its July 2005 recommendations that the Biscay anchovy fishery should remain closed until reliable estimates of the 2006 SSB and 2005 year-class become available based on the results from the spring 2006 acoustic and DEPM surveys. This implies closure of the fishery until at least July 2006.

### 5.2.4.2 Autumn surveys results

Results of the September-October surveys on anchovy juveniles (JUVENA and JUVAGA) were presented to STECF. JUVENA 2005 survey (aiming at producing a recruitment index) has not yet delivered any quantitative acoustic estimate of juveniles, but has detected higher juvenile abundances spread over larger areas (south of 46°N) than in JUVENA2004 (when very few detections were made while failure of recruitment was occurring). Nevertheless, the short series of JUVENA surveys (only 3 surveys) precludes so far any quantitative use of their results. A minimum of 4-5 years of comparisons between JUVENA acoustic estimates of juveniles and recruitment at age 1 estimates in the following year is necessary to decide on the utility of this survey indices for recruitment forecast. JUVAGA surveys also reported on acoustic detections and behaviour of juveniles in different areas. Hence, although these surveys provided qualitative information on juvenile distribution and abundance, they cannot be used yet to predict 2005 year-class strength.

### 5.2.4.3 3.2.4.3 Economic evaluation of the French fleets for anchovy in the Bay of Biscay.

The STECF reviewed working documents (Appendix 1) which describe the evolution of the French fleets that exploit anchovy and evaluate the likely economic impact of a complete closure on the French fishery for anchovy in the Bay of Biscay. The long term evolution of the total annual gross revenue of the French fleets is more stable than the landings because of price effects. More recent figures on the monthly evolution of price and landings underline the sensitivity of price to changes in supply.

A preliminary analysis of the potential impacts of different scenarios bans on the gross revenue and other economic indicators of the main fleets was carried out. It considers the anchovy dependency of the main fleets in terms of gross revenue at an annual and a monthly basis and the potential consequences of different scenarios for anchovy bans based on a retrospective analysis on the fleets gross revenue. Anchovy dependency can be high for some fleets (e.g. 60% annual average for the trawler fleet and the share of anchovy revenue in total gross revenue per quarter can reach 80% for this fleet), but the seasonality of the anchovy landings differs from a fleet to another. Moreover, the quarterly analysis of the variation in gross surplus (in percentage), are larger than the variations in gross revenues.

The evaluation also considered the impact of potential mitigation measures that the fleets may be able to adopt such as directing some of their effort on to species other than anchovy by changing gear used or not. The overall results indicate that cessation of all fishing activity for the trawler fleet targeting anchovy would lead to losses in gross revenue ranging from 40% - 80% depending on the length of closure. Continuing to fish for species other than anchovy but maintaining their base-line activity would result in losses of 55%. Maximizing their potential revenue by targeting species other than anchovy with bottom trawl would result in losses in the region of 20%. The latter option should be considered optimistic since crewing effects, licensing quota restrictions for other species, price effects, etc, have to be taken into account in the predictions. The recent evolution of the situation on other fisheries during the third quarter of 2005 have shown that effort reallocation is problematic (e.g. the example of albacore), for the reasons mentioned before, and leads to a cost (not measured here) for the other fleets targeting these species.

STECF notes that there may be some scope for reducing the economic impact of a closure for the French fleets fishing for anchovy, provided that they are able to diversify their activity and target other species. The analysis suggests that in the most optimistic scenario, losses in gross revenue of the order of -55% could be reduced to -20%. However this is dependent on the period of closure, the availability of other fishing opportunities, their ability to exploit them and the market consequences of changes in supplies.

The analysis of the consequences of the ban on the trawler fleet in terms of economic indicators (gross surplus, crew share) was also carried out. It assumes a shift of fishing effort from pelagic trawl to bottom trawl in the first 6 months of 2006 and the re-opening of the fisheries in July 2006. The analysis considers that the switch from pelagic trawling to bottom trawling implies investments costs in new gears and equipments. The share of gross surplus in gross revenue was around 20% over the period 2001-2003, then it declines in 2004 and in 2005. In 2006, according to effort reallocation (options 2 and 3), these fleets would reach gross surplus ratio levels close to those of the beginning of the years 2000. However, taking into account reimbursement cost (capital and interests) the profitability of a large number of vessels in the fleet would be poor.

It is also possible to consider the spill over effects of the anchovy fishing activity on the harbour activities and the related economic local sectors. In the case of harbors specialized on anchovy (Pays de la Loire region), 200 full time equivalent (FTE) fishermen are supposed to yield 200 and around 300 FTE employment in the harbour's and the local economy, respectively (Baranger et al. 2002). The impacts of the anchovy on specific coastal areas are high compared to other fishing activities.

The results of a complementary analysis presented at the anchovy sub-group SGRST-05-03, July 2005, provides information on other economic indicators (gross surplus or financial profitability). It underlines that theses indicators are more sensitive to the effects of a fishery closure.

STECF notes that it could be useful to consider the impact of different HCR scenarios by providing economic indicators for the fleet targeting anchovy and other fleets operating in fisheries potentially concerned by effort re-allocation. Based on the work presented, the analysis of price effects and the study of markets structure for the main related species should be considered.

#### 5.2.4.4 STECF comments and recommendations

#### 5.2.4.4.1 Harvest control rule for 2006

Given the information presented above, STECF recommends the following:

- there should be a zero TAC for anchovy in Sub-Area VIII (Bay of Biscay) for at least January-June 2006.
- the fishery for anchovy in the Bay of Biscay is only re-opened in 2006, if the results of the 2006 spring surveys indicate that the Spawning Stock Biomass in 2006 is above  $\mathbf{B}_{lim}$  (21,000 t).
- any TAC for the period July-December 2006 should be set at a level that is predicted to result in a SSB in 2007 above  $\mathbf{B}_{pa}$  (33,000 t) according to the following rationale.

5.2.4.4.2 Rationale for prediction of appropriate catch level for anchovy in the Bay of Biscay for the period July-December 2006

To estimate an appropriate TAC for July-December 2006, deterministic short-term projections were carried out for a range of SSBs for 2006 with the following assumptions:

- Fishing mortality for the period July 2006- June 2007 is apportioned equally between the second half of 2006 and the first half of 2007.
- Recruitment of the 2006 year-class in 2007 is set to the 25<sup>th</sup> percentile of the historically observed recruitment.

The results are presented in Table 5-2, which shows the maximum level of catch that can be taken in the second half of 2006, and first half of 2007 to ensure a SSB in 2007 above  $\mathbf{B}_{pa}$ .

Despite the fact that  $B_{pa}$  is not be well defined, STECF considers that 33,000 t is a "reasonable" threshold level, as estimated historical SSBs have been above this level most of the time. It also gives you a high probability of being above  $B_{lim}$ , considering uncertainties in the assessment. The projections in Table 5-2 have been carried out over a large enough range of SSBs for 2006 to include an option to fish at  $F_{pa}$  (estimated by ICES as 1.2 per year). Under this harvest rule the option to fish at  $F_{pa}$  in 2006 is only possible if SSB in 2006 is above 82 000t.

### STECF considerations for a longer-term management regime

STECF notes that the spring acoustic and DEPM surveys provide the main tuning indices to the current assessment and should be maintained. Acoustic and fishing surveys should continue to be carried out in the period of September/October every year to provide an index of abundance of recruits. The survey(s) should cover the known distribution area of the juvenile anchovy and should include pelagic trawling as well as purse seine fishing. All nations and/or institutes involved in the fishery should be encouraged to collaborate in these surveys and STECF **recommends** that co-ordination should be under ICES WGACEGG. The STECF encourages development of any other research surveys that could provide additional information on the recruitment process in this stock.

STECF notes that further to the HCR for 2006, a revision of the current management regime is still required to maintain the longer-term viability of the stock and the fishery. These would need to be scientifically evaluated prior to adoption. As a consequence, STECF **recommends** that a working group evaluate alternative HCRs before next STECF plenary. This evaluation should take into consideration the following elements:

- The recruitment levels and/or the stock recruitment relationship,
- The incorporation of information from the surveys and/or from the fishery in an in-year management procedure.
- The appropriateness of any controls or indicators in addition or alternative to current reference points (B<sub>lim</sub> and B<sub>pa</sub>).
- If possible, the use of all available surveys (spring and autumn) as indicators of recruitment and any alternative timing for those surveys.
- The use of alternative management measures such as TAC level, effort control, area or seasonal closures
- The bio-economic consequences of each HCRs evaluated.

Investigate candidates for  $F_{\text{pa}}$  and  $F_{\text{lim}}.$ 

Table 5-2 Maximum allowable catches for the second half of the year in 2006

January	May			May	2nd H	alf of ye	ar 2006	January	May	1st hal	f of the y	ear 2007
2005	2005	2005 2005	2005 2006	2006	2006	2006	2006	2007	2007	2007	2007	2007
Recruit.	SSB	FMult FBar	Land. Recruit.	SSB	FMult	FBar	Land.	Recruit.	SSB	FMult	FBar	Land.
5 540 000	11 681	0.085 0.073	5 1 203 6 328 063	3 22 006	0.00	0.0000	0	6 328 063	31 096	0.00	0.0000	0
6 170 000	11 681	0.085 0.073	5 1 204 6 328 063	3 24 004	0.00	0.0000	0	6 328 063	32 172	0.00	0.0000	0
6 800 000	11 681	0.085 0.073	5 1 206 6 328 063	326 003	0.00	0.0000	0	6 328 063	33 249	0.00	0.0000	0
7 430 000	11 681	0.085 0.073	512086328063	328 001	0.05	0.0433	603	6 328 063	33 035	0.05	0.0433	1 561
8 070 000	11 681	0.085 0.073	512106328063	3 30 03 1	0.09	0.0780	1 142	6 328 063	33 024	0.09	0.0780	2 857
8 700 000	11 681	0.085 0.073	512116328063	3 32 029	0.12	0.1039	1 600	6 328 063	33 197	0.12	0.1039	3 887
9 330 000	11 681	0.085 0.073	512136328063	3 34 027	0.16	0.1386	2 229	6 328 063	33 064	0.16	0.1386	5 246
9 960 000	11 681	0.085 0.073	512156328063	336 025	60.19	0.1646	2~767	6 328 063	33 144	0.19	0.1646	6 333
10 590 000	11 681	0.085 0.073	512176328063	3 38 024	0.22	0.1906	3 340	6 328 063	33 184	0.22	0.1906	7 444
11 220 000	11 681	0.085 0.073	512186328063	3 40 022	0.25	0.2165	3 949	6 328 063	33 186	0.25	0.2165	8 574
11 850 000	11 681	0.085 0.073	5 1 220 6 328 063	3 42 020	0.28	0.2425	4 593	6 328 063	33 154	0.28	0.2425	9 720
12 480 000	11 681	0.085 0.073	5 1 222 6 328 063	344 018	30.31	0.2685	$5\ 271$	6 328 063	33 089	0.31	0.2685	10 880
13 110 000	11 681	0.085 0.073	5 1 224 6 328 063	346 017	0.33	0.2858	5 821	6 328 063	33 263	0.33	0.2858	$11\ 772$
13 740 000	011 681	0.085 0.073	5 1 225 6 328 063	348 015	50.36	0.3118	6 561	6 328 063	33 141	0.36	0.3118	12 954
14 370 000	011 681	0.085 0.073	5 1 227 6 328 063	3 50 013	80.38	0.3291	7 163	6 328 063	33 264	0.38	0.3291	13 870
15 000 000	011681	0.085 0.073	5 1 229 6 328 063	3 52 011	0.41	0.3551	7 964	6 328 063	33 091	0.41	0.3551	15 066
15 630 000	011681	0.085 0.073	5 1 231 6 328 063	3 54 009	0.43	0.3725	8 616	6 328 063	33 169	0.43	0.3725	16 000
16 260 000	011681	0.085 0.073	5 1 232 6 328 063	3 56 008	30.45	0.3898	9 290	6 328 063	33 226	0.45	0.3898	16 941
16 890 000	011681	0.085 0.073	5 1 234 6 328 063	3 58 006	0.47	0.4071	9 986	6 328 063	33 264	0.47	0.4071	17 888
17 520 000	011 681	0.085 0.073	5 1 236 6 328 063	3 60 004	0.50	0.4331	10 899	6 328 063	33 009	0.50	0.4331	19 099
18 150 000	011 681	0.085 0.073	5 1 238 6 328 063	3 62 002	0.52	0.4504	11 644	6 328 063	33 011	0.52	0.4504	20 053
18 780 000	11 681	0.085 0.073	5 1 239 6 328 063	364 001	0.53	0.4591	12 206	6 328 063	33 275	0.53	0.4591	20 760
19 420 000	11 681	0.085 0.073	512416328063	3 66 030	0.55	0.4764	12 994	6 328 063	33 254	0.55	0.4764	21 731
20 050 000	11 681	0.085 0.073	5 1 243 6 328 063	368 029	0.57	0.4937	13 797	6 328 063	33 210	0.57	0.4937	22 697
20 680 000	11 681	0.085 0.073	51245632806	3 70 027	0.59	0.5110	14 621	6 328 063	33 153	0.59	0.5110	23 664
21 310 000	11 681	0.085 0.073	51246632806	372 025	0.61	0.5284	15 466	6 328 063	33 081	0.61	0.5284	24 631
21 940 000	11 681	0.085 0.073	51248632806	374 023	0.62	0.5370	16 105	6 328 063	33 280	0.62	0.5370	25 361
22 570 000	11 681	0.085 0.073	5 1 250 6 328 063	376 022	0.64	0.5543	16 985	6 328 063	33 184	0.64	0.5543	26 330
23 200 000	11 681	0.085 0.073	5 1 252 6 328 063	378 020	0.66	0.5717	17 885	6 328 063	33 077	0.66	0.5717	27 299
23 830 000	11 681	0.085 0.073	5 1 253 6 328 063	3 80 018	80.67	0.5803	18 566	6 328 063	33 243	0.67	0.5803	28 037
24 460 000	11 681	0.085 0.073	5 1 255 6 328 063	382016	0.69	0.5977	19 501	6 328 063	33 113	0.69	0.5977	29 005

In Table 5-2 maximum allowable catches for the second half of the year in 2006 in the cases where the spawning biomass is above  $B_{lim}$  in 2006, such that in the case of a recruitment at the 25% percentile of the historical available estimates, that fishery (plus a another one at the same level of F in the first half of 2007) would still allow a spawning biomass at  $B_{pa}$  in 2007. These are maximum catches but leading again the stock at  $B_{pa}$  levels in case of a new low recruitment. The simulation is based on a constant fishing pattern across the two half of the year and similar to the one calculated in ICES this year by the application of Integrated Catch at age analysis (ICA). Starting points are 2005 estimates provided by ICA, allowing for the actual catches produced during the first half of 2005 (1200 t) and with no fishing during from 1st July 2005 to 1st July 2006. Calculations were made on a spread sheet. The grey-shaded row corresponds to fishing at  $F_{pa}$  in July-December 2006 and Jan-June 2007 ( $F_{pa}$ =1.2 on an annual basis).

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### 5.2.5 Haddock in the North Sea (ICES Sub-area IV and Division IIIa)

STECF was asked the following:

*Evaluate whether there are inconsistencies in the ICES catch forecast table for haddock in IV and IIIa and, if the case, produce another one.* 

### 5.2.5.1 review of information

STECF reviewed a working paper "Revisions and corrections to the 2005 ICES forecast for North Sea haddock (Needle et al, 2005). This paper presented a number of issues regarding the haddock forecast for catch options in 2006.

The main issues for this forecast are caused by the treatment of the 1999 yearclass which will be age 7 in 2006 and is expected to provide about 2/3 of the landings.

The management agreement for haddock is:-

- 1. Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 100,000 tonnes (Blim).
- 2. For 2005 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups.
- 3. Should the SSB fall below a reference point of 140,000 tonnes (Bpa), the fishing mortality rate referred to under paragraph 2, shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 140,000 tonnes.
- 4. In order to reduce discarding and to enhance the spawning biomass of haddock, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from inter alia ICES.
- 5. A review of this arrangement shall take place no later than 31 December 2006.
- 6. This arrangement enters into force on 1 January 2005.

7.

SSB in 2004 for haddock is estimated to be well above Bpa (140,000 t) so the key element in the management agreement is item 2 above: to restrict fishing on the basis of a TAC consistent with that a fishing mortality rate of no more than 0.30 for appropriate age groups should .

### 5.2.5.2 The ICES Forecast for haddock in Sub-area IV and Division IIIa

The ICES was carried out following standard procedures but because the situation for this stock is atypical the forecast suffered from the following issues.

The WG forecast made use of a plus-group at age 7: this causes problems, as the 1999 yearclass will reach age 7 in 2006 and a general plus-group gives mean weight-at-age and exploitation pattern may not be appropriate.

The age groups used for the calculation of mean fishing mortality was ages 2-4 which excluded the 1999 year-class that is expected to contribute about 50% of the catch and more than 70% of the landings.

The forecast assumed continuation of industrial fisheries in 2005 and 2006 through the inclusion of status quo partial F derived from 2004 industrial fisheries, though the fisheries were almost completely closed in 2005 and may or may not be open in 2006. This issues is dealt with in section 3.2.6.

The method selected for mean deriving weights at age for 1999 year-class was plausible but rather arbitrary.

### 5.2.5.3 STECF Revised Forecast for haddock in Sub-area IV and Division IIIa

The STECF forecast is based on a spreadsheet approach given in the working paper, (Needle et al) which is appended to this report as Appendix 2).

The main features of this forecast are as follows:

- **Numerical methods** follow the standard ICES MFDP equations.
- Weight at age for all year classes except 1999 year class are based on mean of last 5 years excluding 1999 year class, this is the same method as selected for the ICES forecast.
- Weight at age of 1999 year class at age 6 and 7 is based on a regression model on weight at age 5 and a declining linear trend in growth. This modelling approach has been validated at age 6 by comparison with 2005 survey estimates and by cross validation at age 7 in the previous years observations, removing the last three years from the data underlying the model and re-estimating the observed values. The model gave unbiased results in all cases. Details of the model and validation are given in Appendix 2
- **Selection pattern** was the same as that used in the ICES projection but extended to provide constant values for ages up to age 15+.
- Ages for mean F: The management specifies that F should be for appropriate ages, STCF considers that it is important to include the majority of the catch within the ages considered. The management plan was based on an analysis which used mean F ages 2-4, with yield per recruit providing the underlying assumptions for simulations. The yield per recruit is presented in Appendix 2 for both age 2-4 and the extended age range 2-8 these curves are negligibly different so selecting an extended age range does not violate the underlying assumptions. The use of an extended age range is therefore more appropriate and is in accordance with the management plan. STECF considers that the choice of F should be mean ages 2-8.
- **Partial F for industrial by-catch** was set to zero for 2005 and 2006, as the main source of catches of juvenile haddock is the industrial fishery for Norway pout which was closed in 2005 and to a much smaller extent the sandeel fishery that was mostly closed in 2005. For inclusion of industrial by-catch in 2006, which has a negligible influence on TAC and very limited influence on SSB in 2007, see Section 3.2.6.
- **Recruitment** followed the ICES methodology: The RCT3 program was used to provide a forecast of the abundance of the 2005 year-class, based on the application to the 2005 Scottish third-quarter survey index of the historical relationship between the survey and the WG estimates of recruitment. This forecast was around 30 billion, compared to a recent average of around 3

billion. The estimated 1999 recruitment was 112 billion. Recruitment in subsequent years was taken to be around 10 billion, which is the average of the 5 lowest values between 1992 and 2001.

The results of the short-term projections are given in Table 5-3. Fishing at status quo fishing mortality, is predicted to result in human consumption landings of 45,000 t in 2006.

STECF notes that according to the management plan between the EU and Norway, for 2005 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of no more than 0.30 for appropriate age groups. STECF considers that since the bulk of the stock and the predicted catches will be made up of the survivors of the strong 1999 year-class it is appropriate to use age groups 2-8 for the estimation of mean F. The status quo mean F over age groups 2-8 is less than F=0.3 and is therefore consistent with the management plan.

While noting that fishing at a mean F of 0.3 (over age groups 2-8) in 2006 would imply an increase in effort on haddock, STECF **recommends** that management measures for North Sea haddock (Sub-area IV and Division IIIa) for 2006 and beyond be set in accordance with the requirements for the recovery plans for other stocks in these areas. This implies no increase in fishing effort for haddock in Sub-area IV and Division IIIa in 2006.

Table 5-3 Short-term deterministic projections for NS haddock with noindustrial by-catch. Options shaded grey are not considered precautionarySUMMARY

Basis:	F(sq) 2-8 =	0.28	SSB(05)	249	SSB(06) =	254	Bpa =	140
	Landings(05) =	48	– Disc(05) =	9	IBC(06) =	0	Blim =	100
		F(2-8) 06	F mult	Catches 2006	Landings 2006	Disc 2006	IBC 2006	SSB 2007
Zero catch		0.000	0.000	0	0	0	0	302
Status quo		0.285	1.000	64	45	19	0	250
High long-term y	vield	0.180	0.632	42	30	12	0	268
Agreed managen	nent plan	0.300	1.052	67	48	20	0	248
Precautionary limits	F(pa) * 0.1	0.063	0.221	15	11	4	0	290
	F(pa) * 0.25	0.158	0.553	37	26	11	0	272
	F(pa) * 0.5	0.315	1.105	70	50	21	0	245
	F(pa) * 0.75	0.473	1.658	101	70	30	0	222
	F(pa) * 0.9	0.568	1.989	118	82	36	0	209
	F(pa)	0.631	2.210	129	89	40	0	201
Others	15% red. TAC	0.385	1.347	84	59	25	0	235
		0.100	0.351	24	17	7	0	281
		0.200	0.701	46	33	13	0	263
		0.300	1.052	67	47	19	0	246
		0.400	1.402	86	61	26	0	231
		0.500	1.753	105	74	31	0	217
		0.600	2.103	122	85	37	0	204
		0.700	2.454	139	96	43	0	192
		0.800	2.804	155	106	48	0	180
		0.900	3.155	169	116	54	0	170
		1.000	3.505	183	125	59	0	160

### 5.2.6 Haddock in the North Sea (ICES Sub-area IV and Division IIIa)

#### STECF was asked the following:

The forecast for this stock are based on historical levels of industrial by-catches, but there will be no industrial fisheries in 2006. STECF is asked to make forecast

calculations with a range of levels of industrial by-catch (to cover the possibility that the industrial fisheries will be reopened mid year).

The background to this issue and the underlying method used to give the response is given in section 3.2.5.

Table 3-5 illustrates the catch options for the condition with the fishing mortality caused by the industrial fishery by-catch of haddock in 2006 equal to the partial F in 2004. It can be seen in this table that the difference in landings from the human consumption fleet are not very dependent on the industrial fishery. F status quo gives the same landings of 45,000 t for either situation. SSB in 2007 is reduced by about 1.5% if this fishery is reopened at the 2004 level. This effect will also be seen in subsequent years that the fishery is active. Any intermediate level of industrial fishery will have less effect. Increases in the industrial by-catch at levels greater than the 2004 F levels have not been investigated.

STECF notes that this table provides the exploitation options for single stock exploitation regime and that status quo F, using revised set of ages (2-8) that STECF considers to be appropriate according to the requirements of the management plan. Exploitation of NS haddock needs to be considered in accordance with cod recovery plans for the area. Status quo F would imply no increase in fishing effort. Increasing F to F=0.3 implies a small increase in effort.

# Table 5-4 Short term deterministic projections for NS haddock with no industrial by-catch fishery in 2006 and inclusion of an industrial by-catch fishery at the same level as 2004. Options shaded grey are not considered precautionary SUMMARY

Basis:	F(sq) 2-8 =	0.28	SSB(05)	249	SSB(06)	254	Bpa =	140
	Landings(05)	48	= Disc(05)	9	= IBC(06)	0	Blim =	100
	=		=		=			
		F(2-8) 06	F mult	Catches	Landings 2006	Disc 2006	IBC	SSB 2007
Zero catch		0.000	0.000	2000	2000	2000	2000	2007
Status quo		0.294	1.000	70	45	19	6	247
High long-term	vield	0.185	0.632	48	30	12	6	265
Agreed manage	ment plan	0.300	1.022	72	46	19	6	246
Precautionary limits	F(pa) * 0.1	0.065	0.221	22	11	4	7	287
	F(pa) * 0.25	0.162	0.553	43	26	11	6	269
	F(pa) * 0.5	0.324	1.105	76	50	20	6	243
	F(pa) * 0.75	0.487	1.658	107	70	30	6	219
	F(pa) * 0.9	0.584	1.989	124	82	35	6	207
	F(pa)	0.649	2.210	134	89	39	6	199
Others	15% red. TAC	0.396	1.347	90	59	25	6	232
		0.100	0.341	29	16	6	6	278
		0.200	0.681	51	32	13	6	261
		0.300	1.022	71	46	19	6	245
		0.400	1.363	90	59	25	6	230
		0.500	1.704	108	72	30	6	216
		0.600	2.044	125	83	36	6	203
		0.700	2.385	141	94	41	6	191
		0.800	2.726	157	104	46	6	180
		0.900	3.066	171	113	51	6	170
		1.000	3.407	185	122	56	6	160

### 5.2.7 Anglerfish in ICES Divisions VIIIc and IXa

STECF was asked the following:

Advise on the appropriateness of the ASPIC model used by ICES to assess the combined stock of Lophius piscatorius and L. budegassa in VIIIc and IXa for exploring

trends in SSB and F. ICES chose the ASPIC model because there is a lack of appropriate time series of age-based catch data.

### 5.2.7.1 Assessment and Survey results

The ASPIC model implements the logistic stock production model (Schaefer model, 1954). This model estimates total annual stock biomass and fishing mortality based on yield and effort data. The production models may not detect changes in recruitment.

The results of the ASPIC model indicate that F has increased dramatically over the period 2002 –2004. However the data from the commercial fishery in VIIIc and IXa that exploits anglerfish indicate that effort has remained relatively stable and total catch and catch rates have both increased from 2002 to 2004. Furthermore, the fishing mortality on species that are caught together with anglerfish has also remained relatively stable.

The results from the Portuguese and Spanish bottom trawl surveys both indicate an increase in abundance of anglerfish. However, catch rates for anglerfish in both surveys are very low and STECF does not consider that the observed changes in catch rate are necessarily a reflection of the changes in abundance of the stock as a whole.

The increased catches and catch rates in 2003 and 2004 may be attributable primarily to increased recruitment to the fishery of *L. piscatorius* and *L. budegassa* in the periods 2002-2003 and 2001-2002 respectively. This is supported by the observed increase in the numbers of smaller, younger anglerfish in the commercial catch.

The results of the 2005 ASPIC model assessment of anglerfish in VIIIc and IXa indicate a decreasing trend in SSB from the mid-1980s to reach a level in recent years of about 50% of  $B_{MSY}$ .

### 5.2.7.2 STECF comments and recommendations

STECF notes that the use of the ASPIC model for the assessment of anglerfish in VIIIc and IXa is appropriate given the data available for the assessment. However, STECF is not in a position to judge whether it is the most appropriate. Furthermore, while the model provides a good representation of historic long-term trends in F and SSB, it is not an appropriate method to detect any short-term changes in these parameters and is insensitive to short-term changes in recruitment.

### 5.2.7.3 References

- ICES, 2002. Report of the Working Group on Southern Shelf Demersal Stocks. ICES CM 2002/ACFM:
- ICES, 2003. Report of the Working Group on the Assessment of Hake, Monkfish and Megrim. ICES CM 2003/ACFM:

### 5.3 SUSTAINABLE EXPLOITATION RULES FOR BAY OF BISCAY SOLE, CELTIC SEA COD AND ANGLERFISH IN ICES DIVISIONS VIIIC AND IXA

STECF was asked the following:

To deliver an opinion on the work done by a Subgroup on management of stocks (SGMOSD-05-01) which met in Lisbon, 26-30 September 2005 to evaluate "Long-term Management strategies for Bay of Biscay sole, Celtic Sea cod and anglerfish in VIIc-IXa.

### 5.3.1 Background and target reference points for long-term management

In the absence of agreed long term management strategies that lead to safe biological levels, the study group considered  $F_{max}$  as a proxy for a long term target conservation reference point for Celtic Sea cod and Bay of Biscay sole and  $F_{msy}$  in the case of anglerfish in VIIc and IXa.

The Group carried out 3 standard projections, to be used as references: (i) projection at  $F_{sq}$ , (ii) projection at constant catch, (iii) projection with a 10% reduction every year until F reaches  $F_{max}/F_{msy}$ .

### **5.3.2 STECF Comments and Recommendations**

#### 5.3.2.1 Celtic Sea cod

STECF notes that the 2005 cod VIIe-k assessment was not accepted by ICES due to a recent deterioration in data quality. The main issues were un-quantified high-grading of catches since late 2002, unreported catch, the absence of a time-series of discards estimates, and specific concerns over the commercial and research vessel CPUE data.

As a result projections were carried forward using population numbers in 2003 with fishing mortalities in 2004 and 2005 predicted from trends in fishing effort of the main fleets.

Council Regulation (EC) No 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during January-March 2005 was assumed to have resulted in an approximately 10% reduction in F on cod in 2005, based on the analysis by Ifremer (Biseau, 2005).

STECF notes that these procedures may give an over-optimistic estimate of the number of years it will take to reach  $F_{max}$ .

The projections indicate that a constant-catch strategy with catches below 6,000t gives a high probability of SSB falling below  $B_{lim}$  and is not an appropriate strategy.

Progressively reducing fishing mortality by 10% annually until  $F_{max}$  is reached would result in a gradual increase in median landings until 2010 at around 11,600t with a high probability of SSB remaining above  $B_{lim}$ . However STECF notes that results are very sensitive to assumptions regarding the starting populations and initial assumptions about fishing mortality. A combination of smaller initial stock size and reduced future recruitment results in declining landings for the first 5 years and a large risk of SSB falling below  $B_{lim}$ .

Although a 15% variation in TAC constraint was not explored in combination with a progressive reduction in F, the simulations that were undertaken indicate that TAC variations were within the range of year-to-year variations that occurred in the past.

STECF further notes that although progressively reducing fishing mortality by 10% annually until  $F_{max}$  is reached is conditional on the correctness of the assumptions for the early years of the projection and the lack of any implementation error.

Therefore STECF advises that in reality, progressive annual reductions in F well in excess of 10% will probably be required to reach  $F_{max}$ .

#### 5.3.2.2 Bay of Biscay sole

STECF notes that  $F_{max}$  for this stock is well defined at 0.20 with acceptable variability between years (0.02 for the last 5 years). In the absence of any specific management objective, STECF proposes  $F_{max}$  as a target reference point for a long-term management strategy.

SSB for Bay of Biscay sole in 2004 is estimated to be lower then  $B_{pa}$  and fishing mortality in 2004 is estimated to be at about  $F_{pa}$ . However, status quo fishing mortality (average over 2000-2004) is above  $F_{lim}$ . Therefore measures to reduce fishing mortality and increase biomass in the short term are desirable.

Maintaining fishing at status quo fishing mortality would bring SSB further down to a level where the population dynamics are unknown. STECF notes that this is a high-risk strategy and does not recommend it.

Simulations suggest that the stock can sustain landings at a level, similar to the 2005 TAC. Since median SSB is predicted to maintain SSB below Bpa, this strategy is not compatible with the precautionary approach.

STECF **recommends** that taking into account the precautionary approach, in order to ensure that SSB reaches  $B_{pa}$  in the short term; a significant reduction in F is required. In the longer-term subsequent gradual but less severe F reductions towards Fmax might be more acceptable.

STECF notes that there are no options presented with realistic implementation error that result in achieving  $F_{max}$  within 10 years. STECF considers that it cannot recommend an appropriate minimum annual reduction in F as part of a sustainable HCR.

#### 5.3.2.3 Anglerfish in Divisions VIIIc and IXa.

As anglerfish are caught in a mixed fishery with Hake, Megrim, Norway Lobster and other species, Recovery Plans of Southern Hake and Iberian Norway lobster stocks is expected to have some impact on the anglerfish catches.

A non-equilibrium production model (ASPIC) is used as assessment tool. It is apparent that fishing mortality has been over  $F_{msy}$  for the whole data series and SSB shows a decrease since the beginning of the time series with recent values at about 50% of  $B_{msy}$ . The assessment indicates that a 57% reduction in fishing mortality is required to bring F at  $F_{msy}$ . The ASPIC model is not a good estimator of short-term changes in F and SSB, hence STECF is uncertain that the implied recent changes in F have been reliably estimated.

Several evaluations were undertaken, changing fishing mortality and varying the input parameters for projections covering a 50-year period.

Maintaining fishing at status quo fishing mortality SSB is predicted to continue to decline further below  $B_{msy}$  and would bring SSB further down into unknown population dynamics and therefore **not recommended** by STECF as an appropriate management strategy.

Simulations indicate that in a "most optimistic" reducing F-scenario, there is a 50% probability that the decline in SSB will be reversed only in the next 2-7 years and that SSB is not expected to reach  $B_{msy}$  within three decades.

With no fishing after 2005, biomass will increase at around 10%, 20% or 30% depending on the assumed input parameter and will reach  $B_{msy}$  level in 2013-2012-2011 respectively.

Given the uncertainties in input parameters used for simulation and the current status of anglerfish in VIIIc-IXa, STECF strongly **recommends** that a substantial reduction in fishing mortality is needed as soon as possible. STECF notes that even with zero catches of anglerfish in VIIc-IXa after 2005, there is less than a 50% probability of achieving B<sub>msv</sub> by 2011.

Given the current state of the stock and the absence of clear objectives relating to the desired rate of stock recovery, STECF is unable to advise on an appropriate long-term management strategy.

STECF notes that regulating F with days at sea for static gears is unlikely to be an effective instrument. Anglerfish in VIIIc-IXa are taken in about equal amounts by static gears and trawl fisheries.

#### 5.3.2.4 References

- ICES, 2006a. Report of the Working Group on the Assessment of Hake, Monk and Megrim. ICES CM 2006/ACFM:01.
- ICES. 2006b. Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks. ICES CM 2006/ACFM: 03.
- BISEAU, 2005 Working document to the 2005 Working Group on the Assessment of Southern Shelf Demersal Stocks - Effect of the Cod closure (ICES rectangles 30E4, 31E4, 32E3) in the Celtic Sea on the fishing behaviour.

### 5.4 MIXED FISHERIES

STECF was asked the following:

STECF should deliver an opinion based on the work done by subgroup SGRST-05-02 (17-21 October, 2005) which compiled recent data on demersal mixed fisheries, identified stocks, areas and fleets where there are significant mixed catches and estimated catches for 2006.

### 5.4.1 background

The Commission convened a STECF-SGRST mixed fisheries meeting in Ispra (Italy) at the JRC premises during 17-21 October 2005 as a follow up of a series of annual meetings, with the following terms of reference:

- 1. Obtain and compile all available recent data concerning mixed-species demersal fisheries in Community waters and adjacent areas. The data of specific interest are landings and discards by species and by fleet, where possible disaggregated by age and by number of fish.
- 2. Review the data compiled in (1) and identify those stocks, areas and fleets where significant technical interactions exist and for which adequate data exist to permit those interactions to be evaluated.
- 3. For each of the area-fleet-stock groupings identified in (2), calculate catch forecasts for 2006 for the stocks concerned, based on:
  - the most recent ICES assessments
  - ACFM advised catches for 2006
- 4. an appropriate range of assumptions for the factors describing the relative policy weights to be attached to each fish stock, including any particular values that may be requested by the Commission services on receipt of the ICES advice.
- 5. In support of the above tasks, continue methodological and software development as initiated by this Ad Hoc Working Group since 2002.

The main conclusions and STECF comments and recommendations are presented below.

### **5.4.2 STECF Comments and Recommendations**

STECF agrees with the findings presented in the report of October 2005 STECF-SGRST meeting on mixed fisheries and has drawn the following conclusions and recommendations:

- 1. STECF notes that sampling of catch at sea including discards to quantify technical interactions between mixed demersal fisheries is expensive and difficult. This means that sampling coverage tends to be rather limited, and raised estimates of discards are subject to high uncertainty. This is true of all of the discard estimates, and in some cases the discard estimates presented represent the first attempt to use the discard data from some fisheries in an advisory context. Where the coverage is considered adequate to estimate the overall catch compositions of specific fleets these are presented in the sub-group report. However STECF considers that, they only provide an approximate indication of fleet catch compositions.
- 2. Technical interactions between mixed demersal fisheries in the North Sea and Skagerrak, Kattegat and West of Scotland only, are indicated in the report based on estimated catch data including discards.
- 3. Both the lack of stock specific forecast inputs on stock size and exploitation rates and considerable concern regarding incomplete fleet specific catch data including discards prevented meaningful analytical mixed fisheries forecasts for the management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish Sea, Porcupine Bank, Celtic Sea, Bay of Biscay and around the Iberian Peninsula.
- 4. All mixed fisheries scenarios for the North Sea and Skagerrak that attempt to balance the ICES advice for 2006 of 0-TAC for cod and a 0.68 F-multiplier for plaice, indicate that stringent cuts in fleet-specific fishing mortality are required across the board. Such overall cuts imply that the fishing possibilities as advised under precautionary single species boundaries would have to be severely reduced. STECF considers that the fleet landings and discard information and specific stock parameters are too imprecise to provide MTAC runs that are an acceptable basis for management advice.

### 5.5 ASSESS THE EFFECTIVENESS OF THE COD RECOVERY PLAN

STECF was asked the following:

STECF should deliver an opinion based on the conclusions of subgroup meetings SGRST-05-01 (13-17 June 2005) and SGRST-05-4 (19-21 September 2005) which aimed to (a) identify the location and season of the most important fishable concentrations of cod in the North Sea, Skagerrak, eastern Channel, Kattegat, Baltic Sea, west of Scotland, Celtic Sea and the Irish Sea (b) review the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004) (c) evaluate systems feasible for management of fishing effort in the context of a multi-annual management plan for the cod stocks in the Baltic Sea.

### 5.5.1 Background

STECF notes that the objectives of the cod recovery plan are rebuilding targets related to SSB increases, and the maintenance of fishing mortality below precautionary levels. Unfortunately these objectives were not embodied within the Terms of Reference of these SGRST meetings. SGRST's terms of reference included a request to review of "the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004)."

STECF considers that the effectiveness of the cod recovery plan is best evaluated with reference to the current status of cod recovery stocks. STECF considerations of the current status of cod stocks are given by the SGRST in the Stock Status Review (SGRST-05-04)

### **5.5.2 STECF comments**

Under the present term of reference STECF was asked to base its opinion on the reports of the SGRST meetings 05-01 and 05-04. The following STECF comments on the effectiveness of the cod recovery plans consider the sub-group's discussion of effort limitation.

Effort limitation was introduced in "cod recovery" areas as a mechanism for achieving desired reductions in fishing mortality. These effort regulations limited the days that vessels of different categories may spend at sea but did not specify how these limitations related to previous levels of effort exerted. Furthermore, the introduction of days at sea restrictions was not accompanied by clearly defined objectives for the reduction of effort, nor for fishing mortality, and the relationship between effort and fishing mortality remains unclear. The SGRST review of the efficacy of effort regulations was therefore complicated by the lack of stated objectives of the regulations in terms of intended fishing mortality reductions.

### 5.5.3 Trends in effort for the main fleets exploiting cod

The SGRST summarised recent trends in nominal effort (kW days) by the main fleets:

- For the west of Scotland effort data were reported for the whole of Division VIa rather than for the area within which effort is regulated. SGRST was therefore unable to evaluate changes in effort exerted by regulated gears to the west of Scotland.
- In the Irish Sea, there has been an overall decline of 19% from 2000-2004 in the effort exerted by vessels using 70-99mm meshes. From 2000-2003 the nominal effort of demersal trawlers using ≥100mm mesh increased. In 2004 the effort reported for this category declined by 19% relative to 2000 (38% relative to 2002). There is some evidence since 2002 of a transfer of effort from trawls using ≥100 mm mesh to 70-99mm mesh. The nominal effort in 2004 of beam trawlers using ≥ 80mm mesh has decreased by 15% and 35% compared to 2000 and 2002, respectively.
- In the North Sea and Skagerrak, the total nominal effort for all demersal gears decreased between 2000 and 2004 by 21% (15% between 2002 and 2004). Demersal trawlers using ≥100mm mesh showed the greatest decline in effort (43% since 2000, 35% since 2002), while the effort of demersal trawlers using 70-99mm mesh increased by 54% and 12% over the same periods. Between

2000 and 2004 nominal effort of beam trawlers using  $\ge$  80mm mesh declined by 25% (14% between 2002 and 2004).

- In the Eastern Channel, total nominal effort increased between 2000 and 2004 by 22%, and decreased between 2002 and 2004 by 3%. Demersal trawlers using 70-99mm mesh accounted for most of the fishing effort, and this increased by 14% between 2000 and 2004 and decreased by 3% during 2002-2004.
- In the Kattegat, total nominal effort decreased by 27% during the period 2000 to 2004 (16% between 2002 and 2004). Effort of demersal trawlers using ≥100mm mesh decreased by 79% whilst that of demersal trawlers using 70-99mm mesh decreased by 22% between 2000 and 2004.

STECF notes the SGRST conclusion that effort regulations have provided an incentive for some vessels previously using >100mm mesh demersal trawls to switch to smaller mesh gears, thus claiming a higher number of days-at-sea. Under EC Regulation No. 850/1998 these vessels are also required to target either *Nephrops* or anglerfish, megrim, and whiting, with various catch and bycatch composition limits.

The SGRST findings of minimal decreases / increases in the effort of trawlers using 70-99mm mesh and simultaneous decreases in the effort of  $\geq$ 100mm mesh demersal trawlers indicate an overall reduction in the mesh size used in demersal fisheries. Adherence to catch composition regulations required when using 70-99mm mesh would result in high-grading and discarding of cod and other species. The SGRST report provides evidence of discarding of cod, and other demersal species, particularly in the 70-99mm mesh category.

The SGRST was also provided with information on the control and enforcement of effort regulations (Commission's evaluation report: Cod recovery verification programme 2004, Working Document 9 to SGRST-05-01). The report considers that the actual reduction in terms of fishing effort by the main fleets is likely to have been modest, that high-grading and misdeclaring of cod was a common practice during 2004 and that landings composition regulations of the regulated gears were poorly enforced.

### **5.5.4 STECF conclusions and recommendations**

STECF draws the following conclusions from the SGRST report:

- high-grading, discarding and mis-declaring of cod will compromise the intended impact of effort management,
- current exploitation rates remain excessive in the context of the cod recovery plan.

Given these conclusions STECF considers that effort controls, as currently formulated in Annex IVa of Regulation 27/2005, have not, and are unlikely to satisfy the objectives of the cod recovery regulation.

### 5.6 HARVEST CONTROL RULE FOR SAND EEL IN NORTH SEA AND SKAGERRAK AND ACTIONS FOR 2006

STECF was asked the following:

To deliver an opinion based on the outcome of the ad hoc working group ADHOC-05-03 which aimed to (a) evaluate whether the current HCR for sand eel in the North Sea and Skagerrak are suitable or need to be changed (b) determine what actions shall be envisaged for 2006 on the basis of the ACFM advice and considering that Council Regulation n.1147/2005 of July 2005 has prohibited sand eel fishing until the end of 2005 on the basis of the agreed HCR; (c) assess what level of monitoring fishing (sentinel fishing) shall be allowed in 2006 with a view of monitoring the 2005 recruitment strength in case that a 0 TAC or a very low level of fishing effort need to be established for 2006.

### 5.6.1 Harvest control rule for sand eel in North Sea and Skagerrak and actions for 2006

STECF was asked the following:

To deliver an opinion based on the outcome of the ad hoc working group ADHOC-05-03 which aimed to (a) evaluate whether the current HCR for sand eel in the North Sea and Skagerrak are suitable or need to be changed (b) determine what actions shall be envisaged for 2006 on the basis of the ACFM advice and considering that Council Regulation n.1147/2005 of July 2005 has prohibited sand eel fishing until the end of 2005 on the basis of the agreed HCR; (c) assess what level of monitoring fishing (sentinel fishing) shall be allowed in 2006 with a view of monitoring the 2005 recruitment strength in case that a 0 TAC or a very low level of fishing effort need to be established for 2006.

### 5.6.2 Review of ad hoc sand eel WG

STECF reviewed the report of the ad-hoc working group on sand eel, which met at short notice for 3 days running concurrently with the STECF plenary meeting. STECF acknowledges that the timing in relation to the STECF plenary meeting has prevented the report from undergoing the usual process of self-review and that the short notice reduced the ability of the group to do justice to the ToRs

The ad-hoc group met principally to evaluate a range of potential harvest control rules (HCRs) including the Commission's current HCR. The group was also tasked with compiling information regarding the ecosystem requirements for sand eel as a food source. The only analytical assessment of sand eel consumption available to the group was from the ICES study group on multi-species assessment in the North Sea (SGMSNS) which, using MSVPA, estimates average consumption of at least 1.7 million tonnes. This estimate does not include consumption by seals, cetaceans and most non-commercial fish species.

For the purpose of HCR evaluation, the group used new software, which is an extension of the SMS (Stochastic Multi-Species) model. The projection framework follows the STPR3 approach, which has previously been used by ICES (AGLTA). The SMS HCR implementation makes use of half-annual time steps, which is applied for the sand eel assessment. Essentially the HCR is applied to "observed" or "perceived" stock numbers and translated into a TAC, which is subsequently taken from the true population. Uncertainty enters the system as observation noise, recruitment variation and implementation error. The HCR evaluation framework has further options to further refine HCRs in terms of limiting inter-annual change in TAC or F, which were not explored by the group but are potentially useful options for managers to consider.

Management of North Sea sand eel is particularly problematic due to the fishery being principally on the 1-group whilst there is no reliable assessment estimate of this year-class at the time of the December Council to assist TAC setting. Currently the Commission uses an in-year monitoring system in the first 17 weeks of the year to estimate the size of the 1-group and subsequently enact management. Within the HCR evaluation model it was assumed that the fishery in the part year before a management decision is reached operates with a fixed F of 0.1. Historical performance of the in-year estimation of the 1-group indicates a CV of 35%, whilst the observation uncertainty from the assessment of other age groups is assumed to be 25%. Recruitment was generated from a hockey-stick stock-recruit relationship parameterised from historical assessments and a fixed inflexion point of 430kt (B<sub>lim</sub>). One of the group's ToRs was to investigate whether there were grounds for changing the value of B<sub>lim</sub>. However there was no new information to suggest that changes were warranted.

A range of HCRs was evaluated, including the Commission's current HCR as well as use of a fixed TAC and target SSBs.

The use of a fixed TAC as a management tool would do away with the need for the in-year estimation of the 1-group. In the long term (10 years) a TAC of around 200-300kt would ensure that SSB would be below  $B_{lim}$  with a <5% probability. The probability of being below  $B_{lim}$  in 2007 is around 65% due to the current poor state of the sand eel stock.

The in-year estimation of the 1-group permits the fishery to take, around 500kt (long term average) whilst complying with the SSB<B<sub>lim</sub><5% condition. The HCR currently employed by
the Commission implies frequent closure of the fishery immediately after the in-year estimation. Another HCR, using  $B_{pa}$  (600kt) as a target SSB for the following year results in a lower probability of closure whilst still complying with the SSB< $B_{lim}$ < 5% condition. However, use of  $B_{pa}$  as a target implies that true SSB is  $<B_{pa}$  about 35% of the time. The use of an HCR based on an SSB target results in a lower probability of being below  $B_{lim}$  in 2007 compared to the Commission's current HCR.

In order to investigate the performance of HCRs in the event of lowered recruitment, scenarios were run where mean recruitment was 50% of the historical value. Under this scenario the F=0.1 inflicted by the monitoring fishery is such that the probability of being below  $B_{lim}$  is well in excess of the 5% limit. Another scenario, with a hockey stick SSB/R relation and an inflection point at the 25 percentile of the historical values, showed a probability that true SSB is  $\langle B_{pa} \rangle$  at less than 5% of the time. Long-term yield for this scenario was about 500kt.

All of the HCRs evaluated by the group give a high probability of SSB in 2007 being less than  $B_{pa}$ , even with a minimal F of 0.1 as inflicted by the monitoring fishery. WGNSSK, using a short-term deterministic forecast with 25<sup>th</sup> percentile recruitment suggested that and F of 0.2 would permit the stock to be over  $B_{pa}$  in 2007. The difference between these results are due to the model used, SMS being more pessimistic regarding the current stock status than the seasonal XSA adopted by WGNSSK. In addition, the SMS simulation uses the hockey stick SSB/R relation, which with the present low SSB produces a low recruitment.

The minimum escapement implied by the use of a target SSB rule does not directly address the in-year ecosystem requirements for 0 and 1-group sand eel. Resolving this issue is not a straightforward exercise and requires further work.

The group were asked to comment on the level of monitoring fishery required for reliable estimation of the incoming year-class. The group has previously reported that a minimum of 100 biological samples, covering the main sand eel fishing grounds is required. The monitoring fishery is currently market driven in terms of effort and location, subject to a maximum effort cap of KW days for the North Sea as a whole. There was no information available to determine appropriate effort levels at finer spatial subdivisions. The group recommends that the current effort cap remains in force as a means of preventing excessive F before the strength of the incoming year-class can be evaluated.

#### 5.6.3 STECF comments and recommendations.

### 5.6.3.1 Long-term considerations

The ad-hoc group presented a number of HCRs and scenarios most of which perform similarly in terms of probability of being above B<sub>lim</sub> and long-term yield. The main difference between the scenarios is the inter-annual variability in yield. Without further guidance from managers regarding long-term objectives for the stock and fishery, STECF cannot recommend any one HCR over another. The signal from the Danish fishing industry is however a preference for a more stable yield and capacity reduction. In the long-term, an HCR based upon a target SSB *may* perform better in terms of stability of yield than the Commission's current HCR, however the outcome is highly sensitive to the target SSB chosen. Furthermore, ecosystem considerations, including predator requirements for sandeel, need to be taken into account in determining an appropriate target SSB.

# 5.6.3.2 Options for 2006

The short-term prognosis for the sandeel stock is uncertain and highly dependent upon the strength of the incoming year-class. ICES advice for 2006 is to achieve Bpa by 2007. STECF notes that there is a real possibility that even in the absence of fishing in 2006, SSB in 2007 will not reach Bpa.

There is currently no alternative to the use of fishery data for either assessment of North Sea sandeel or the estimation of the incoming year-class strength. Unless managers are willing to enter a phase of total uncertainty regarding North Sea sandeel stock status, a monitoring fishery at the start of the 2006 is a prerequisite despite the risk of preventing the stock reaching  $B_{pa}$  in

2007. However STECF notes that in the longer term, exploiting sandeel at F= 0.1, (estimated mortality of the monitoring fishery) poses little risk to the stock.

STECF therefore recommends that the in-year estimation of the 1-group continues in 2006.

STECF further **recommends** the maintenance of the current cap on effort (40% of the total effort deployed in 2004) at least until the decision on a HCR for 2006 is agreed and implemented by managers.

STECF **recommends** that managers decide on an appropriate target SSB for 2007 that is not less than Bpa (600,000 t). Pending the estimated size of the 2005 year-class following the monitoring fishery, the total catch for 2006 should not result in a predicted SSB in 2007 that is below the agreed target.

STECF stress that all of the above recommendations are conditional on management action being taken immediately following the evaluation of the monitoring fishery and implementation of the HCR.

# 5.7 FISHING EFFORT FOR VESSELS IN THE CONTEXT OF THE RECOVERY OF CERTAIN STOCKS

STECF received three communications from elements of the North Sea fishing industry: two from Dutch Fishery Sector and one from Scottish Fishermen's Federation via the North Sea RAC. These are listed as items 1.2.6, 1.2.7 and 1.2.8 in the Terms of reference. Since they are inter-related, these are considered here under sections 3.7.1, 3.7.2 and 3.7.3.

In considering each of these proposals STECF was cognisant of the following issues:

- 1. STECF welcomes proposals from the industry to improve the efficacy of effort regulation and considers such proposals to be a positive development. Any measures that have the support of the industry are more likely to be successful than measures imposed by regulatory authorities.
- 2. Effort controls, as currently formulated in Annex IVa of Regulation 27/2005, have not, and are unlikely to satisfy the objectives of the cod recovery regulation (See response to ToR 2.d in Section 3.5)
- 3. Despite this misgiving, STECF considers that the concept of regulating days at sea is probably the most effective method in place for controlling effort in fisheries and therefore welcomes any measures that reinforce or increase the effectiveness of this measure. STECF does not support measures that may increase fishing effort in fisheries that impact on depleted stocks.
- 4. STECF recognises that fisheries that exploit several stocks and/or discard add complexity to fisheries management. STECF welcomes any measures that improve species- and size-selectivity in catches so that fisheries may reduce their impact on non-target species and reduce discards of target species. STECF considers that measures that increase discards and catches of non-target species should be discouraged.
- 5. Increased segmentation of regulated gear categories potentially creates control, enforcement, implementation and monitoring difficulties.

STECF concludes that a comprehensive review of effort regulations is required. STECF considers that proposals such as those received from the industry should be considered in the context of such a review. Therefore STECF **recommends** that the Commission convenes a series of expert working groups under the auspices of STECF to review Effort Regulations, with terms of reference that include the following:

- Define appropriate objectives for the effort regulations,
- Evaluate the effectiveness of existing effort regulations with respect to these objectives,
- Consider proposals for amendments to the regulations that:
  - $\circ~$  improve effectiveness in the context of recovery of depleted stocks, and,

- o are consistent with management requirements of other stocks.
- improve species- and size-selectivity in catches so that fisheries reduce their impact on non-target species and reduce discards

Therefore, in this report STECF only presents preliminary responses to the industry proposals.

# 5.7.1 Proposal by the Dutch fishery sector regarding the position of beam trawlers in the Cod Recovery Plan (Annex IVa of Council Regulation 27/2005 of 22nd December 2004).

STECF was asked the following:

STECF should check, consider and give an opinion on the request from the Dutch fishermen forwarded by the North Sea RAC to remove beam trawlers with V nets from Annex IVa of the 2005 TAC (Council Regulation 27/2005 of 22 December 2004) and to regulate the effort of this fleet within the scope of a plaice management plan.

## 5.7.1.1 Preliminary STECF response

STECF welcomes the increased exchange of ideas on the revision of the days-at-sea regime in Annex IVa. The document submitted by the Dutch Fisheries Organisation describes problems in the days-at-sea regulation related to annex IVa and vessels that use beam trawls. It argues that proportionality (in terms of cod by-catch of a fleet) was an inherent part of the formation of the days-at-sea regulation, and that a "level playing field" has not been applied to those affected by the regulation or its implementation. It suggests that the Dutch beam trawl fleet is inappropriately listed in the annex. It also welcomes the European Commission offer, in its non-paper "Development of effort management", to open discussions on the amendment of the restriction on days at sea regime, Annex IVa of the TAC and Quota Regulation 27/2005.

STECF considers that the principle concerns of the Dutch fishing sector are:

- 1. The definition of the 5% by-catch of cod within annex IVa (paragraph 6d)
- 2. Whether the application of annex IVa with regard to the by-catch is consistent across all fleets
- 3. Whether annex IVa covers both the cod and the plaice recovery plans

The document also suggests that the Dutch beam trawler fishing fleet is willing to voluntarily cooperate in Real Time Closures for cod, to expand on its own discards study for cod, and is willing to take along observers on board, as a contribution to the recovery of cod stocks.

The industry proposal concludes that the beam trawler fleets with V nets with 80-99 mm and V nets with mesh  $\geq 100$  mm have caught by-catches of less than 5% cod since before the reference year of Annex IVa (2002). The time series of Dutch beam trawl nominal hp days (source LEI, The Netherlands) does suggest a sizable reduction in effort in the fleet, but this does not account for year on year increase in efficiency of the fleet. The SGRST (cod recovery) meeting in 2005 showed that both the Dutch fleet of beam trawlers (>=80mm mesh) and total North Sea beam trawl fleet had a reduction in effort of 25% (in terms of kw days-at-sea) between 2000 and 2004.

Issues relating to the methods used for estimating the numbers of cod discarded by fleets are described in the SGRST report. STECF notes that there is poor precision in the estimation of discarded cod in many fleets. However, discounting the discarding of cod, the records of landings of cod in 2003 and 2004 by the beam trawl fleet were still sizable (5370 tonnes in 2003 and 3754 tonnes in 2004, making 18% and 14% respectively of the total international landings of cod (Table 4.3.1, STECF Mixed Fisheries Report (SGRST-05-02),. In terms of weight estimated from landings alone, cod appears to have made up less than 5% of the total landings of the Dutch V net beam trawlers in 2000-2003 (data source VIRIS, Dutch Ministry for Agriculture, Nature and Food Quality, Fisheries Directorate).

STECF notes that Table I of paragraph 6(a) of Annex IVa of Council Regulation 27.2005, restricts beam trawlers using a mesh size greater than or equal to 80 mm to 13 days per month. A derogation of 14 days (i.e. the allocation of an additional day), which according to Table II in paragraph VId ofAnnex IVa of Council Regulation 27/2005, may be allocated to beam trawlers using meshes of at least 120mm, that on the basis of their 2002 track record, it can be shown that they caught less than 5% cod. STECF also notes that for demersal towed gears other than beam trawls a derogation to have no restriction on the number of fishing days is only allowed if on the basis of their 2002 track record it can be shown that they caught less than 5% of each of cod, sole and plaice.

Although STECF has no documented explanation as to the basis for Annex IVa, it appears that it is designed to impose days at sea restrictions on those fishing vessels that on the basis of their 2002 track record have been shown to have a landing composition that contains at 5% or more of cod or for some fleet categories 5% or more of each of cod, plaice or sole.

STECF wishes to stress that in terms of reducing the mortality on cod or on other stocks, a rule that imposes days at sea restriction on individual vessels, based on the proportion of cod in their overall landings is unlikely to be an effective measure, since it is the mortality on the stock that is generated by the fleet as a whole, that must be managed. Furthermore, the proportion of the international TAC landed by Member States' fleets, is largely determined by the quota available to those fleets. STECF also wishes to stress that basing effort restrictions solely on the proportions in landed catch, takes no account of the actual fishing mortality rate being exerted by those fleets.

In the case of the Netherlands' beam trawl fleet, the reported landings of cod for 2003 and 2004 accounted for 14% and 18% of the international landings of cod from the North Sea and Skagerrak. Hence, STECF concludes that the Netherlands' beam trawl fleet is a significant contributor to the fishing mortality on North Sea cod and as such, should be subject to the effort restrictions that are agreed under the cod recovery plan.

# 5.7.2 Proposal for amendment of Annex IVa of the EU TAC and quota regulation 27/2005- Fisheries with demersal trawls other than beam trawls from the Dutch Fisheries Organisation.

STECF was asked the following:

STECF should check, consider and give an opinion on the request from the Dutch fishermen forwarded by the North Sea RAC to (1) restructure days at sea in Annex IVa for demersal trawls other than beam trawls and (2) split the days-at-sea, now defined as consecutive period of 24 hours, in two 12 hour periods.

## 5.7.2.1 Preliminary STECF response

STECF welcomes discussion with the fishing industry and the increased exchange of ideas on the revision of the days-at-sea regime in Annex IVa. The document submitted by the Dutch Fisheries Organisation describes problems in the days-at-sea regulation related to annex IVa and vessels that use demersal trawls, and proposes changes to the regulation and annex. It argues that the current effort restriction regime is counterproductive, which may be the case, in that the spatial distribution of the fleets has changed due to the restriction of effort and the regime favours the use of smaller meshes. It calls for more equity (with proportionality) in the application of the days-at-sea to those fleets with low by-catches of cod, a clear distinction to be made between the role of annex IVa in terms of the protection of cod and the protection of plaice and the creation of a mechanism to encourage the use of larger mesh sizes.

The specific proposals are:

1) Restructuring of Annex IVa for demersal trawls other than beam trawls are shown in Table 5-5

2) Redefinition of a day-at-sea into two 12-hour periods (currently defined in Annex IVa, Paragraph 3 as a consecutive period of 24 hours).

Category	Description	Days-at-sea
		Allocation
4a	demersal trawls* using mesh of ≥120mm	9
4e-1	demersal trawls* using mesh 70-99mm	18**
4e-2	demersal trawls* using mesh 100-119mm	21

Table 0-0 anocations for demerasi trawis other than beam trawis	Table 5	5-5 a	allocations	for	demerasl	trawls	other	than	beam	trawls
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\* Other than beam trawls

\*\* Based on proposals by the Scottish Fishermen's Federation for the Nephrops fishery, which are currently under discussion in the NSRAC

STECF does not have the information available at present to assess the impact of the current proposals, nor their utility. Advice on alternatives can only be given after closer analysis of the effectiveness of the current regime and a full evaluation of the influence of the new proposals.

STECF considers that moving to a 12-hour reporting period will result in an increase in the amount of effort deployed in terms of fishing hours without any apparent change in the number of days fished. Furthermore, STECF considers that such an amendment may also result in increased fishing pressure on fishing grounds close to ports.

Any proposed change to Annex IVa should result in a decrease in fishing effort and not result in either the status quo, or an increase in fishing mortality.

# 5.7.3 Proposal for amendment of Annex IVa of the EU TAC and quota regulation 27/2005. SSF / North Sea RAC proposal for effort, selectivity and enforcement changes.

## STECF was asked the following:

STECF is requested to comment on the proposal from the *Scottish Fisheries Federation* forwarded from the North Sea Regional Advisory Council (NSRAC) for improving the basis of target species (*Nephrops*) management and enhancing selectivity in the finfish by-catch in small mesh fisheries in the Northern North Sea, evaluating where possible the biological and economic effects of the measures proposed.

## 5.7.3.1 Summary of proposals:

STECF received the following proposed changes to the regulation:

## • Tighten effort control

- Reduce flat rate days-at-sea allocation for vessels in the mixed *Nephrops* fishery (the 80-99mm trawl, 4e, category) from 21 to 18 days:
- Within that, provide incentives to use more selective gear for those using a mesh size of at least 95mm, number of days increased to 21,
- For vessels with a track record of less than 5% cod pre-2002, derogation of unlimited days only available if using 95mm mesh size.

## • More selective gear

- 4mm twine single nets (Current Scottish Legislation)
- Inclusion of a 120mm square mesh panel at least 5m in length

## • Data collection

- Observer programme to provide detailed biological information on *Nephrops* catch and by-catch species,
- Scientific tally book scheme providing spatially resolved information on catch and effort.

## • Enforcement

• Reduce threshold for prior notification to a designated landing port notification to 500 kg of cod

## 5.7.3.2 General comments and observations

STECF notes three elements to the proposal: (1) improved enforcement, (2) improved selectivity in *Nephrops* fisheries, and (3) changes to effort through changes in days at sea regulations. In the preliminary analysis conducted by STECF each of these topics has been examined separately. In the case of both selectivity and days at seas changes, STECF was not able to predict realisable effort effects for these changes but has provided some information on potential benefits or potential changes. The realisation of potential benefits depends on the extent to which these changes are taken up by the fishermen, though STECF considers that measures that have the support of the industry are more likely to be successful than measures imposed by regulatory authorities.

## 5.7.3.3 SFF/ NSRAC Proposed Enforcement Measures

STECF is unable to advise on the consequences of the change in enforcement but supports increased monitoring of cod catches in order to more accurately estimate cod mortality.

## 5.7.3.4 SFF / NSRAC Proposed Selectivity measures

STECF welcomes the proposed changes to the selectivity of the fishing gears and has evaluated the potential benefits of these measures through simulations of effects on cod and haddock populations in terms of stock size, landings and discards.

The North Sea cod and haddock fisheries are modelled using 3 fleets:

- 1. the Scottish otter trawl fleet using mesh sizes between 80 and 100mm (the *Nephrops* fleet)
- 2. the Scottish otter trawl fleet using mesh sizes above 100mm (the whitefish fleet)
- 3. A third international fleet comprising all other fisheries taking haddock and cod is also modelled.

The selectivity and effort applied by both the Scottish whitefish fleet and the international fleet are assumed to remain constant. 'North Sea' should be interpreted as meaning ICES sub-area IV and divisions IIIa and VIId for cod and sub-area IV and division IIIa for haddock as these are the areas for which the data are available.

The method is based on that described in Kunzlik (2003). Data were obtained from FRS Aberdeen on the landings and discards and weights of haddock and cod at age for individual Scottish gears. Similar disaggregated data by gear at age are available from the STECF database for all the international fisheries in the North Sea. The 2004 values for stock numbers, total fishing mortality, proportion mature and natural mortality are taken from the 2005 WGNSSK Working Group Report or in the case of cod from the trial run in file ado\_all04.csv used by the WGNSSK. Recruitment is assumed to be constant and near the average for the last 10 years although this has little effect on the comparative results. The long-term effects of changes assumed to be implemented in 2006 are obtained.

## 5.7.3.5 Gear options

Table 5-6documents the mesh and panel combinations tested. A lifting bag is permitted in all cases. The panel must be fitted so that e.g. in option 1, its aft edge is no more than 13m from the codline (the end of the codend). The minimum length of panel is indicated by the range.

Table 5-6 Gear options tested

	Codend	Open	Twine		Pane	Panel	Haddoc	Cod
	MS	meshes			$1\mathrm{MS}$	position	k	L50
						from codline	L50	
Scotland	80	120	4s	=	90	15-18m	21.9	24.5
2004			4mm					
spec			single					
Option 1	80	120	4s		120	13-18	26.2	29.3
Option 2	80	120	4s		120	6-9	28.5	31.9
Option 3	95	100	4s		120	13-18	32.0	35.8

The 50% retention lengths are estimated from the model in the STECF Expert Group report (Anon, 2003). It should be noted that the new cases lie outside the range of gears used to develop the model. Data on square mesh panels with a mesh size of 120mm or of 5m length in a position 13-18m from the codline have not been tested. Further selectivity data obtained from gears closer in specification to the proposed measures may be available shortly from Denmark. If these data become available the studies may need to be repeated.

## 5.7.3.5.1 Cases to be run

Two scenarios are run. It is first assumed that no technical change is implemented – this is the baseline case. The model is then run again with the technical change implemented. The baseline for the Scottish *Nephrops* fleet is shown under "Scot 2004 spec" in Table 5-6 and is the gear currently required of Scottish fishermen. It is more selective than under EU regulations as 4mm single twine and a 90mm square mesh panel must be used. It should be noted that the precise specification used as the baseline will not significantly affect the conclusions made in this paper.

The gear changes indicated in the above table are applied only to the Scottish *Nephrops* fleet and the whole of this fleet is assumed to adopt the change. This will give an indication of the magnitude of the effect of each option. All effects are the long-term effects after the measures have been in place for 8 years so that the benefits to the stock as a whole can be seen.

# 5.7.3.5.2 General findings for the potential effects of selectivity changes both cod and haddock

The proportion of the total catch of North Sea cod and haddock taken by the Scottish *Nephrops* fleet is quite small - <5% for cod and <10% for haddock. The proposed measures therefore do not have a significant effect on the total stock size (3% or less) nor consequently on the landings of the Scottish whitefish fleet and other international fleets.

The main effects are in the discard rate for the Scottish *Nephrops* fleet and in some cases on the level of landings by that fleet.

5.7.3.5.3 Option 1 – Proposal to use 120mm square mesh panel at 13m from the codline

A reduction in haddock discards by the *Nephrops* fleet of 23% is achieved and of 29% for cod. For haddock this weight of discards saved is equivalent to about 1% of the total haddock catch by all North Sea fleets. For cod it is not significant.

## 5.7.3.5.4 Option 2 – Positioning the 120mm panel at 6m from the codline

Trials have been undertaken in Denmark on this particular gear. Square mesh panels have been found to be more effective when they are placed further aft nearer the codline. Discards are the main beneficiary with reductions of about 44% for haddock and 49% for cod. For haddock this weight of discards saved is equivalent to about 1.5% of total haddock catch by all fleets.

5.7.3.5.5 Option 3 – Proposal to move to 95mm codend mesh size as well as a 120mm panel at 13m from the codline

This case was proposed as an option to encourage use of a larger mesh size in the *Nephrops* fishery. In the long term, landings of cod and haddock by the Scottish

*Nephrops* fleet would drop by about 4% and 14% respectively, compared to the levels they would have been with no change in technical measures. Discards of haddock would be reduced by 72% in Scottish *Nephrops* gears. This weight of discards saved is equivalent to about 2% of the total haddock catch by all North Sea fleet. Discards of cod would be reduced by about 74% but this represents only a very small fraction of the total cod catch.

## 5.7.3.6 SFF/NS RAC proposed effort restrictions.

It is difficult to estimate what the effect of the proposed restrictions will be on individual vessels, because we don't know how each skipper shares their allocation between *Nephrops* and fish, and so exactly what a vessels allocation is. In addition the data available is on a an ICES rectangle basis for each voyage, and the allocation of time is by whole voyages, so effect of different effort regimes spatially will not be correctly modelled.

Current days at sea regulations limit *Nephrops* trawlers using mesh of 80-99mm to 21 days, while vessels with less than 5% of each of cod, plaice & sole are unlimited in their days.

Effort (days absent) by Functional Unit or remaining part of *Nephrops* Management Areas is tabulated below, (Table 5-7) for the Scottish *Nephrops* gears TBN and TBNT, as reported in the Scottish Fisheries Information Network (FIN) system.

Days a	Days absent, TBN & TBNT											
North	Sea											
	BG	FD	OHR	FF	FL	MF	NO	MA:H	MA:I	MA:S	MA:G	MA:F
2001	8	307		11735	2968	4292	111	2	821		31	59
2002		397		9160	4628	4878	341	1	766	16	57	71
2003	5	337		8094	1621	2916	222	53	276	22	40	84
2004		155		8574	969	2861	167	9	51		28	40
West o	coast											
	NM	SM	CL	MA:C		ISE	ISW					
2001	3697	2972	4518	100		31	12					
2002	4629	2463	2999	37		12						
2003	4448	3238	2053	47			6					
2004	4016	2768	1640	23		17	7					

Table	5-7	absent from	Fisheries	Information	Network	(FIN)	system.
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(BG-Botney Gut, FD – Farn Deeps, OHR – Off Horn Reef, FF – Firth of Forth, FL – Fladen, MF – Moray Firth, NO – Noup, NM – North Minch, SM – South Minch, CL – Clyde, ISE – Irish Sea East, ISW – Irish Sea West)

Not all vessels targeting *Nephrops* are listed using these gears in the FIN database, and a more appropriate way to estimate total effort targeting *Nephrops* is to allocate vessels by landings composition. Scottish trawl gear landings compositions (2001-2004) were analysed on an individual voyage basis using the "clara" routine within the "cluster" package of R. The landings compositions for the 12 most distinct clusters of fisheries are shown in Figure 5-30ver 2001-2004, clusters 4, 5 and 10 have accounted for 94.7% of Scottish *Nephrops* trawl landings. The total days absent by category are given in Table 5-8.



Figure 5-3 Fishery identified fleets based on clustering analysis of landings data

Table 5-8 Days absent based on landings based fleet definitions.

Days a	Days absent, Nephrops fisheries											
North	North Sea											
	BG	FD	OHR	FF	FL	MF	NO	MA:H	MA:I	MA:S	MA:G	MA:F
2001	14	932		14335	12267	6607	282	26	2389	54	167	275
2002	417	1083	342	7239	17120	5660	1507	1742	3141	4094	9562	2349
2003	452	810	194	5657	13115	6047	1107	1836	2813	3659	6704	1835
2004	479	639	253	6373	12891	6048	676	1620	3175	2594	4832	1189
West o	coast											
	NM	SM	CL	MA:C		ISE	ISW					
2001	10287	13722	11979	411		25	42					
2002	6718	6875	7346	4831		32	169					
2003	6605	8641	7065	4683		38	181					
2004	6161	7876	5868	3595		60	70					

It is thought that Table 5-8 provides a better estimate of *Nephrops*-directed effort, as several *Nephrops* boats are recorded in the FIN database as using the gear categories OTT or OTB.

On this basis of fisheries definitions determined by landings compositions, the clean *Nephrops* fishery (number 4, with 99% *Nephrops* in the landings) is assumed to be currently unrestricted by days at sea limitations, while the other 2 *Nephrops* fisheries (numbers 5 & 10, with 64% and 36% *Nephrops*) are assumed to be in the category currently limited to 21 days.

The assumption is to take all the vessels that have been included in one of the *Nephrops* fleets at any time, and assume that all their effort except that allocated to the clean *Nephrops* fishery (number 4) is subject to the 21-day limit. This may not be the case as some vessels may also target whitefish, and end up with half the *Nephrops* and half the fish allocation for example ([21+9] / 2 = 15 days). For such vessels the chosen approach will not indicate any reduction, whereas there would in fact be a reduction (to [18+9] / 2 = 13.5 days). In this respect the approach may underestimate the total effect.

The figures are tabulated below (The top block show monthly levels of effort (days absent) by vessels identified as sometimes targeting *Nephrops*, in all fisheries except the unregulated *Nephrops* fishery. The second block then caps monthly effort by these vessels to 18 days. The third block shows the relative change associated with the capping of days at 18, instead of 21. It can be seen that over the whole year, the effect varies between 8-11%. The bottom block shows the effort in the unrestricted *Nephrops* fishery.

Table 5-9 The monthly levels of effort (days absent) by vessels identified as sometimes targeting Nephrops, in all fisheries except the unregulated Nephrops fishery (top block). Capped monthly effort by these vessels to 18 days (second block). The relative change associated with the capping of days at 18, instead of 21 (third block). The effort in the unrestricted Nephrops fishery (bottom block).

North Sea

historical observed days

Month

	1	0	2	1	5	6	7	0	0	10	11	10	toto1
	1	4	3	+	3	0	/	0	9	10	11	14	
2001	5353	5514	3908	5152	6572	7993	8335	8978	6883	6577	5842	5022	76128
2002	5018	4961	5191	5225	5887	6291	7826	7481	6730	5681	5113	4681	70084
2003	4104	4240	4136	3933	5242	5811	6597	6151	5600	4727	4031	3161	57733
2004	3603	3399	3494	3554	4329	5178	6189	5247	4295	4424	4450	3673	51834
adjust	ed days	(any >1	8 reduc	ed to 18	)								
2001	5206	5141	3731	4705	5757	6583	7097	7397	6232	5887	5435	4849	68019
2002	4761	4671	4728	4725	4962	5390	6198	6314	5913	5096	4734	4452	61943
2003	3926	4032	3820	3609	4523	5000	5475	5557	4945	4348	3776	3117	52126
2004	3486	3323	3313	3317	3859	4507	5111	4754	4065	4085	4110	3549	47480
adjust	ed/histo	orical											
2001	0.97	0.93	0.95	0.91	0.88	0.82	0.85	0.82	0.91	0.90	0.93	0.97	0.89
2002	0.95	0.94	0.91	0.90	0.84	0.86	0.79	0.84	0.88	0.90	0.93	0.95	0.88
2003	0.96	0.95	0.92	0.92	0.86	0.86	0.83	0.90	0.88	0.92	0.94	0.99	0.90
2004	0.97	0.98	0.95	0.93	0.89	0.87	0.83	0.91	0.95	0.92	0.92	0.97	0.92
unlimi	ited effor	rt (<5% )	cod etc)										
2001	1698	1870	1244	1617	2386	2615	2795	3196	2281	2152	1950	1763	25568
2002	1823	1710	1807	1764	1805	2115	2599	2803	2400	1794	1881	1393	23894
2003	1198	1291	1453	1274	1650	1717	2428	1951	1876	1465	1280	950	18532
2004	1205	1223	1137	1323	1450	1692	2062	1774	1578	1612	1456	1192	17703

In Table 5-9 the "restricted" fleets (top 2 blocks) may include other fisheries on squid for example that shouldn't be restricted. If only fisheries having 5% cod in landings are included, the overall effect of the restrictions reduces to between 5-7% (Table 3-10).

Table 5-10 Effort for Nephrops fleets with >5% cod catch. The monthly levels of effort (days absent) by vessels identified as sometimes targeting Nephrops,

in all fisheries except the unregulated Nephrops fishery (top block). Capped monthly effort by these vessels to 18 days (second block). The relative change associated with the capping of days at 18, instead of 21 (third block).

North Sea

historical observed days

Month													
	1	2	3	4	5	6	7	8	9	10	11	12	total
2001	4354	4493	3165	4155	5405	6519	6717	7240	5652	5355	4774	4135	61964
2002	4048	4045	4283	4317	4815	5204	6416	6167	5405	4595	4237	3816	57348
2003	3304	3464	3381	3264	4310	4815	5339	5020	4608	3951	3323	2527	47306
2004	2994	2769	2874	2920	3595	4140	5046	4303	3483	3570	3694	3037	42425
adjust	ed days	(any >18	8 reduce	ed to 18)									
2001	4299	4345	3063	3983	5020	5832	6118	6442	5341	4974	4552	4049	58018
2002	3953	3917	4024	4073	4321	4753	5527	5585	5023	4331	4042	3716	53266
2003	3231	3366	3239	3100	3893	4370	4813	4744	4294	3754	3208	2510	44522
2004	2928	2717	2783	2812	3369	3857	4481	4049	3396	3426	3548	2963	40328
adjust	ed/histo	orical											
2001	0.99	0.97	0.97	0.96	0.93	0.89	0.91	0.89	0.94	0.93	0.95	0.98	0.94
2002	0.98	0.97	0.94	0.94	0.90	0.91	0.86	0.91	0.93	0.94	0.95	0.97	0.93
2003	0.98	0.97	0.96	0.95	0.90	0.91	0.90	0.95	0.93	0.95	0.97	0.99	0.94
2004	0.98	0.98	0.97	0.96	0.94	0.93	0.89	0.94	0.97	0.96	0.96	0.98	0.95

It is difficult to translate these effort changes into cod mortality but at the current level such a reduction in effort would have only limited benefit to cod recovery.

### 5.7.3.7 Conclusions to SFF / NS RAC proposal

STECF considers that the measures proposed all potentially make a positive contribution to reduction of fishing mortality on cod and, as such, should be encouraged. They have the potential to reduce the by-catch of small haddock and cod in the *Nephrops* fisheries. However, there is low level of by-catch of cod and haddock in the *Nephrops* fisheries examined. Therefore, in the context of the entire fishery, the proposals for these fleet segments would have a rather limited overall reduction on cod or haddock. Impacts on other species were not evaluated. The observations on the improvements in selectivity are based on a selectivity model and it would be better if these could be validated in practice. STECF would encourage experimental evaluation of these measures.

STECF notes that observations of interaction are based on recent previous catch compositions in which young cod and haddock have not been prevalent. Any future increases in recruitment of haddock and cod (of the type reported in the ICES WGNSSK in 2005) which produce distributions of young fish coinciding with *Nephrops* grounds, would result in a stronger interaction than that modelled.

## 5.7.3.8 References

Anon, 2003. Report of Expert Meeting on Cod Assessment and Technical Measures. Brussels April/May 2003, Appendix 5.

Kunzlik, P.A., 2003. Potential impacts of recent UK national and EU international regulations on North Sea roundfish fisheries. ICES CM2003/Z:08

# **6 FISHERIES ECONOMICS**

# 6.1 PROPOSE A WAY FORWARD FOR BIO-ECONOMIC MODELLING IN THE EU

STECF was asked the following:

The recent subgroup meeting SGECA-SGRST-05-01, assessed bio-economic models, their data requirements and ongoing projects. Based on the outcome of this meeting STECF should propose how better bio-economic advice can be delivered in the future.

# 6.1.1 Background

STECF decided in 2003 to organize a series of subgroup meetings with the purpose of investigating the availability of bio-economic models, which could be used to support the advice of STECF on fisheries management. Firstly, a joint subgroup of SGECA and SGRST was asked to review the EIAA model, which is used to assess the economic repercussions of the ACFM advice i.e. fisheries that are subject to quota management. Secondly, a subgroup for Mediterranean fisheries should review models appropriate for economic assessment of fisheries not subject to quota management. Thirdly, the joint SGECA-SGRST subgroup was asked to review available models in a broader context. The meetings should be accomplished during 2004 and 2005.

The subgroup meeting about the EIAA review was held in June 2004, while the meeting in October 2005 addressed models in a broader context including models for fisheries in the Mediterranean Sea.

Further more, STECF emphasized that the review of the models should focus on the operationality of the models with respect to the needs of the Common Fisheries Policy in terms of TAC/quota management and fleet management. The operationality should include availability of data on a continuous basis.

The draft report from the October 2005 meting at Ispra concentrates on compilation of information about the pertinent models and is as such a valuable contribution to the discussion on the models usable for STECF.

## 6.1.2 Terms of reference for the subgroup

STECF has the following observations related to the terms of reference and the draft report.

## 6.1.2.1 Item 1. Objectives and methodologies of the bio-economic advice

1. Critically review the methodology of the bio-economic advice as it has been carried out in the CA and give adjusted methodologies.

The report notes that the EIAA model developed in the CA is a useful tool for shortterm projections of the TAC/quota advice given by the ACFM and review by SGRST. The model is restricted by output in terms of TAC/quotas, and calculates the derived costs. Over the recent years input restrictions in terms of sea days have become still more binding, and it would be a useful development to include this restriction in the model. Further, it is considered useful to carry out projections that include in a more explicit way the impact of oil price increases (or other important price or cost changes). Finally, it is pointed out that the impact of resource rent should be considered, and how this issue could be developed.

2. Set out methodologies for the bio-economic advice in case of no stock assessments are available

The report points out that in most cases some stocks are subjected to assessment although the fisheries are not managed by quota restrictions but input restrictions. The bio-economic advice is sustained by input driven models that include a stock component which takes into account assessed stocks as well as stocks not subjected to assessment. These secondary stocks are included either as a function of the assessed stocks by use of time series analyses or by use of surplus production models.

It is the opinion of the STECF that models are available, but that reference points for management should be clarified.

3. Make a set of important bio-economic indicators that could be used as the basis of the advice

The report identifies two sets of indicators:

Biological indicators including spawning stock biomass and fishing mortality. These indicators are valued against reference points such as the precautionary principle and the lowest acceptable limit.

Economic indicators including operating profit margin and return on capital showing the economic performance of the fleet segments. These indicators are equally assessed against reference point such as interest rates on financial markets (e.g. interest rate on bonds).

The report touch upon indicators that should combine biology and economics by including resource rent. The report also presents indicators such as capacity utilisation as a useful indicator of the situation of the fishery.

STECF notes that the work finding common indicators for biology and economics needs to be elaborated.

## 6.1.2.2 Item 2. Review of types of models used

The report presents the scope of eight models where the causality of the models is that one is developed to be restricted by output mainly (quotas), five are constructed to be restricted mainly by input and two of them was optimisation models restricted by both input and output. These models serve different purposes.

STECF emphasises that it is important to clarify the operationality of the different models. This should require the models chosen to have

- proper documentation,
- software available and
- data available

#### 6.1.2.3 Item 3. Relevant projects

This item has not yet been addressed by the Sub-group

### 6.1.2.4 Item 4. Data requirements

Data requirements are covered under the review of types of models used where it is stated that all the models are capable of running by use of the data prescribed by the data regulation 1639/2001 at least in the extended programme, but many of them requires further data input to be fully exploited.

STECF finds it necessary to detail the data requirements for all the reviewed models.

## 6.1.2.5 Item 5. Adjustment of data regulation

The group has highlighted that on one hand consistency over time in the fleet segment is required for making comparisons, but that this segmentation also hides the importance of different gear types, in particular if vessels use many different gear types throughout the year.

STECF emphasises that economic data can only be collected on an annual basis and on a business or vessel level, rather than on a gear perspective. From the economic point of view the prevailing fleet segmentation offers homogenous and applicable groups.

## 6.1.2.6 Item 6. Advice procedures and organizational framework

The group distinguishes between regular tasks, ad hoc tasks and strategic long-term tasks. The regular task i.e. the Annual Economic Evaluation of the ICES advice requires a solid structure that can be put quickly into operation, and this would require that the human and financial resources necessary to carry out the work may not (cannot) be secured safely only by relying on ad hoc group meetings.

The ad hoc tasks and strategic long-term tasks are not to the same extent dependent on a solid structure. These tasks require models that include interaction between the fleets and stocks and are able to include various harvest rules and uncertainty.

STECF finds it necessary to reconsider the procedures and organizational framework after finalization of the subgroup report.

## **6.1.3 General observations and recommendations**

In general STECF observes that the draft report is incomplete in addressing the terms of reference of the subgroup. Therefore STECF recommends that the subgroup reconvenes with the purpose of finalizing the submitted report. In particular the emphasis to be put on the elaboration of operational models that produce information which make it possible to assess the situation of the fishery in a combined biological and economic way, i.e. produce common indicators.

STECF recommends that based on the current overview of available models a selection should be made of those models that are at present operational, publishable and do have a specific use for STECF. In addition it is recommended to establish a task force that will for each selected model create a manual on the use and data requirement of the specific model.

Furthermore it is reiterated that the economic data should be made available by the member states in due cause to allow for a proper assessment of the economic situation of the selected fisheries and to enable STECF to assess the economical impact of the proposed TAC/quota regime for the forthcoming year. In order to facilitate this process it is stressed that no later than the first of October the data for the past year should be made available to JRC. JRC will then stage the analysis of the data, resulting in both an assessment of the Economic Situation of selected fishing fleets and, by running the appropriate models, predict future developments.

STECF emphasizes that member states should be in a position to make available to JRC in time data on the economical position of the fishing fleet, preferably based on accounting information, but if not available in time, based on a proper estimate of the situation.

# 6.2 ASSESS THE ECONOMIC IMPACT ON EUROPEAN FLEETS OF THE LATEST ICES-ACFM ADVICE

STECF was asked the following:

STECF should deliver an opinion based on the outcome of the EIAA model calculations made during the SGRST-SGECA meeting of October 24-28, 2005.

## **6.2.1 AER (Annual Economic Report)**

On the basis of the preliminary report from the Concerted Action (FISH/2005/12) the STECF makes the following comments:

The report presents economic results for 2004 of 69 fleet segments, representing about 55-60% of the total fishery sector of the EU in terms of value and volume of landings and over 40% of employment. Coverage by country varies between 3-4% for Greece and 100% for Italy and other countries. In the European Union as a whole some 186,000 fishermen produced in 2004 approximately EUR 7.1 billion worth of fish. Compared to the year 2000, the nominal value of production has decreased by approximately 8-9%. The inflation over this period amounted to 9% so that the real value of the landings decreased since 2000 by some 19%. Employment in the fisheries of the EU-15 has decreased in the same period by about 50,000 jobs, i.e. 21%.

Out of the 69 specific segments on which data is presented, the short term performance of 39 segments has deteriorated compared to average 2002/2003. These 39 segments represented 73% of the total production value and 71% of crewmen.

Average value of fish landings per fisherman in the surveyed fleets in the EU-15 amounted to EUR 58.000. Consequently, the production value per fisherman in fisheries not covered by the report can be estimated at some EUR 34,000. The value of production per man in the surveyed fleets of the new Member States amounts to EUR 14,500. This difference in productivity can partly be explained by the structure of the Baltic Sea fisheries, higher capital intensity in the EU-15 countries and wage differences.

STECF notes a general loss across most segments and observed that the figures of the Mediterranean fishery are dominated by the Italian fleet. STECF queries the upward tendency of the net profits for the Mediterranean which are not in parallel with the rest of European segments.

# 6.2.2 Fisheries in 2006

## 6.2.2.1 The Economic impact of TAC regulations

As for the preceding years *The Potential Economic Impact on Selected Fishing Fleet Segments of TACs Proposed by ACFM and reviewed by SGRST for 2006 (EIAA-model calculations)* report gives an assessment of the economic impact of the TACs proposed by the ACFM.

To carry out an assessment of the economic impact of ACFM advice using the EIAA model, the fleet segments examined need to be subject to quotas, and knowledge of the catch composition for the national fleet and each fleet segment is also required. The costs and earnings information is from the Annual Economic Report (AER). The segments included are those for which necessary information is available in terms of TAC/quotas, catch compositions and costs and earnings. The selected segment must have an annual gross revenue of at least EUR 10 million in 2004. The following adjustments have i.a. been made:

- The TACs for each species are caught with an up-take-ratio calculated from the base period's landings relative to the allocated quotas.
- Future prices are base period prices adjusted with a flexibility rate of 0.2 based on the whole TAC for the EU for the relevant species.
- The stock-catch flexibility rate is 0.6 for demersal species, reflecting their spatial density, and 0.1 for pelagic species owing to their shoaling behaviour. Hence, an increase in stock abundance lowers the amount of effort.
- The change in effort is proportional to the change in the quotas for the relevant segment.

Costs are calculated at fixed prices (base period) but adjusted proportionally with the change in effort for future years. The calculation about the long term economic consequences uses information about spawning stock biomasses and long term yield. The members of the SGRST working group have provided that information. The EIAA-model is constructed to work with a list of TACs for the management areas as complete as possible.

Concerning the TAC indications for 2006 based on the ACFM and reviewed by the SGRST the potential economic impact of three scenarios based on different assumptions of TAC proposals have been evaluated. The three scenarios are:

- 1. Single species TACs. As far as possible, TACs for 2006 were taken directly from the ICES advice for single species exploitation boundaries. These were used to demonstrate the economic performance of the fishing fleets in 2006 relative to the average 2002-2004 baseline run if TACs were set according to the single species advice and ignoring any interactions between stocks and fisheries. For some stocks, the single species advice is for zero catch in 2005 and in such cases the TAC input to the EIAA was therefore zero. For other stocks, ICES was unable to provide quantitative assessments and advice on catch options for 2006 and in such cases the TAC for 2006 was set equal to the 2005 TAC.
- 2. TACs set in line with ICES' mixed fishery advice. This scenario was undertaken to evaluate the economic performance of the fleets when the interactions between stocks and fisheries are taken into consideration. This represents a worst-case scenario, since it implies zero catch for a large number of demersal stocks that are caught in mixed fisheries. The group has interpreted the wording "with minimal by-catch or discards of cod" and

minimum bycatch of other species as meaning a zero TAC for those species and for the other species caught in the same fisheries.

3. TACs set in line with existing management agreements and proposed management plans. For several stocks management agreements exist. For such stocks, the group selected the TAC consistent with such agreements. For other stocks not subject to management agreements the 2005 TAC was set in line with single stock exploitation boundaries. Pelagic stock TACs were set according to single stock exploitation boundaries, since there is no significant interaction with demersal stocks in the fisheries exploiting pelagic species.

Concerning the Assessment of the Economic Impact of Proposed TACs for 2006 by Fleet Segments the economic consequences of the three scenarios described above are assessed using the economic indicator of operating profit margin, defined as the net profit relative to the value of landings. The net profit is defined as the value of landings minus all costs.

The general conclusion stemming form the analysis is, that based on the proposed TAC/quota for 2006 the majority of fleet segments included in the analysis will, relative to the base period, either see there economical situation **Worsen** (Segment was making losses, losses now greater) or see there profit **Lower** (Segment was making profits, profits now lower).

It is important to emphasize that the model is used to project the economic repercussion of different TAC/quota scenarios only. This approach entails that prices and costs that are independent of the TAC/quotas are kept unchanged relative to the baseline period (average of the three preceding years). Consequently the projections do not take into account the effect of the increased oil prices in 2004 and 2005. Furthermore, landings may be restricted by the limited number of fishing days introduced from 2003 but with effect from 2004.

## 6.2.2.2 Fuel price rise

Out of the 69 segments presented in the AER report, data for 64 segments is used to assess the consequences of the increase of fuel price during the first 10 months of 2005.

The aggregate size of these 64 segments is:

- Number of vessels 20,704
- Engine power 1.969,000 kW
- Gross tonnage 880,000 GT
- Landings 2,896,000 tonnes
- Value of landings 3.216 billion EUR
- Employment 60,849 fishermen

Several scenarios of the consequence of a structural fuel price increase are presented in the Table 6-1.

Table 6-1 Aggregated	consequences	of fuel	price	increase	on	surveyed	fleets
(million EUR)							

			Gross		Gross
		Crew	cash	Net	value
	Fuel costs	share	flow	profit	added
Situation 2004:	604	1,011	674	252	1,685
Fuel price +25%:	755	953	582	159	1534
Fuel price +50%:	907	894	489	67	1,383
Fuel price +100%:	1,209	777	304	-119	1,081

In many countries fishermen are paid on share basis, often a percentage of the value of landings after costs of fuel have been subtracted. For the 64 fleet segments, the average share amounts to 39%. Consequently, when fuel price rises, part of the expenses is born by the crews.

The table shows that these fleets have spent in 2004 approximately 600 million EUR on fuel and at the same time realized an aggregate profit of 252 million EUR. The fuel prices were in October 2005 approximately 60% higher than the price at the end of 2004. If the fuel price would for a prolonged period of time increase by 50%, than the crew share would deteriorate by

11% and the gross cash flow by 28%. The aggregate net profit would still be slightly positive. This positive result is however largely attributable to the performance of the 6 segments of the Italian fleet. Most other segments would not only face a net loss but also their gross cash flow would be close to zero, so that they would not be able to meet their debt obligations.

# 6.2.2.3 STECF conclusions of the economic impact of the ACFM advice for 2006

When the STECF, in an overall view, is considering the fuel prices, the current situation in fisheries as described in the AER, and the results of the EIAA model calculations, it is obvious that the fleet segments targeting demersal species with towed gears could be in a serious economic situation in 2005 and this state might be made worse during 2006 due to major restrictions on fishing due to the state of certain stocks. The segments using passive gears will be less touched by the high fuel prices but they could also be affected by the stock situation. The purse seiners targeting pelagic species will not be affected to the same magnitude but the trawlers will be seriously influenced by the fuel price. The STECF also has some doubts if such a substantial decrease of the crew share, as indicated in the table is socially possible. If there will not be any substantial price increases, many enterprises could face bankruptcy due to this combination of factors. Trying to curb this trend by way of input subsidies does not address the underlying fundamental structure of the fisheries such as over-capitalization and extensive fuel consumption in towed-gear fisheries. However this situation might facilitate the necessary re-structuring of the European fishing fleet and hasten the recovery of many critical stocks. Though many fishermen will face unemployment.

Finally it is observed that in the Mediterranean areas, where there is no agreement for changes to the present fisheries management setup, economic costs can exist as a consequence of the continuation of the present situation. Given the absence of concrete proposals these hidden costs are not being evaluated at present by the STECF.

# 6.3 ASSESS MEMBER STATES' PROGRESS IN ACHIEVING A SUSTAINABLE BALANCE BETWEEN FISHING CAPACITY AND FISHING OPPORTUNITIES

STECF was given the following Term of reference:

The Commission, on the basis of the data in the Community Fleet Register and information contained in the Member States' annual reports, has prepared a summary annual report and presented it to the Scientific Technical and Economic Committee for Fisheries on 29 July 2005. STECF should provide its opinion on this report.

# 6.3.1 Background

Article 14 of Council Regulation (EC) No 2371/2002<sup>1</sup> and Article 12 of Commission Regulation (EC) No 1438/2004<sup>2</sup> require Member States to submit to the Commission, before 1 May each year, a report on their efforts during the previous year to achieve a sustainable balance between fleet capacity and available fishing opportunities. On the basis of these reports and the data in the Community Fishing Fleet Register<sup>3</sup>, the Commission produced for the year 2004, a summary<sup>4</sup> which was presented to the 'Scientific Technical and Economic Committee for Fisheries' (STECF) and the 'Committee for Fisheries and Aquaculture'. This report presents the considered opinion of the STECF on the Commission's Summary Report.

<sup>&</sup>lt;sup>1</sup> Council Regulation (EC) No 2371/2002 (OJ L 358 of 31 December 2002, p.59 -80)

<sup>&</sup>lt;sup>2</sup> Commission Regulation (EC) No 1438/2004 (OJ L 204 of 13 August 2004, p.21-28)

<sup>&</sup>lt;sup>3</sup> Commission Regulation (EC) No 26/2004 (OJ L 5 of 9 January 2004, p.25-35)

<sup>&</sup>lt;sup>4</sup> Annual Report from the Commission to the Council and the European Parliament on Member States' effort during 2004 to achieve a sustainable balance between fishing capacity and fishing opportunities. COM (2004)799

## **6.3.2 STECF Comments and Recommendations**

STECF notes that the Commission's report is presented in two main parts; one describing the rules governing the management of capacity and the information that member states are required to submit to the Commission, and a second describing the development of Member States' fleet capacities during 2004.

STECF is of the opinion that the aim of achieving a balance between fishing capacity and resource availability is crucial for the long-term viability of the EU fleets. Continued over-capacity and over capitalisation compared to the economic optimum<sup>5</sup> will tend to lead and maintain over-exploitation, which is likely to result in unsustainable fisheries.

STECF notes that in their National Reports submitted to the Commission, Member States emphasised the implementation of national fleet management rather than the assessment of the balance between fishing fleet capacity and available fishing opportunities. In terms of physical capacity the EU fleet reduced by 69,500 GT and 321,000 kW over the years 2003 and 2004, representing net reduction of 3.7 % of the total tonnage and 4.7 % of power of the EU-15 fleet. Furthermore, STECF also notes that in new Member States, starting from 1 May 2004, fleet capacity has been reduced by 7,000 GT and 18,500 kW. This represents a reduction of 3.1 % in the total tonnage and 3.3 % of Power for the fleets of new Member States.

The report from the Commission points out that there has been an improvement in compliance with the regulation by Member States and that the degree of non-compliance is rather small. If this is the case then by definition, the agreed targets to reduce overcapacity must also have been rather small and in the opinion of the STECF, far too small to effect the reductions in exploitation rates required for the majority of stocks exploited by the EU fishing fleets. In economical terms this situation is clearly reflected in the Annual Economic Report 2005, in which it is shown that most of the European fishing fleets operate at negative or zero profit level.

While the reported reductions in GT and kW represent an attempt to move towards a balance between fishing capacity and available fishing opportunities, reductions in physical capacity alone, are insufficient to achieve this objective. Not only are the reported reductions rather trivial, compared to the existing imbalance between fishing opportunities and fleet capacity, to achieve such a balance, there is a need to reduce the EU fleet's capability to catch fish, and not simply its physical capacity.

A reduction in physical capacity alone does not equate to a reduction in the capability to catch fish, since the latter is a function of numerous factors; physical, technological, temporal and economic, each of which can be used by managers to influence exploitation rates according to their objectives.

STECF notes that the implied objective of managing the fishing capacity of the EU Fleet, is to achieve a balance between the capacity and available fishing opportunities, it is how the capacity that exists at a particular time is deployed and the availability of fish resources at the same time that will achieve the correct balance.

A current overriding objective from a biological perspective is to achieve exploitation rates that are consistent with Maximum Sustainable Yield ( $F_{msy}$ ) by 2015. In principle this can be achieved with the existing EU fleet capacity, provided it is deployed in such a way that results in the desired level of fishing mortality. It is how the capacity is deployed that will influence the exploitation rate, and not the physical capacity itself. Hence, taken in isolation, the EU capacity management rules as implemented at present are rather a blunt instrument, which in principle may work against the objectives of fishery managers. Depending on the objectives of the managers, the decisions they take and the degree of compliance with those decisions, the desired balance between exploitation rates and resource availability could be achieved by a large capacity fleet being deployed for a small amount of time or a smaller fleet for a longer amount of time.

<sup>&</sup>lt;sup>5</sup> The economical optimum, or Maximum Economical Yield in this respect, balances investment and returns in a fishery to the level in which the resources are optimally allocated.. In a single species set up this will lead to, compared to the Maximum Sustainable Yield, taking the production function (or yield curve) and cost curve into consideration, a situation in which less effort will be applied

However sustainable from an ecological perspective, this rather large overcapacity, or underutilisation of resources is from an economical and social perspective unsustainable.

From an economic perspective, if the fleet is underutilized (as measured by f.e. days at port, or time spend not fishing, but also in terms of over investment in capacity), this is a measure of overcapacity and economic waste. From an economic point of view the aim should be at maximising the economic resource rent of the fisheries i.e. profits of the fishing fleets. This process of optimisation will result in a most advantageous size of the fleet, i.e. the minimum and efficient capacity to harvest the long-term sustainable stock.(Maximum Economical Yield, MEY;  $F_{MEY}$ )

If the overriding objective of the EU capacity management rules is simply to reduce the physical capacity of the EU fleet, the rules as they exist, may continue to achieve this. However, it is debatable whether this alone will result in any reduction in the fleets' capability to catch fish. The time series of capacity measures for different fleets do suggest a sizable reduction in capacity for some fleets, but do not account for year on year increase in fishing capability of the fleet.

STECF **recommends** management objectives to be set for 'manageable units' i.e. set objectives for those EU fleets that can be managed independently. In addition, it should be taken into account that from a stock assessment perspective (i.e. MSY) and an economic perspective (MEY) and from a governance perspective (i.e. full employment) different sets of objectives can be formulated. STECF therefore **recommends** that a common set of objectives be established for those EU fleets and fleet segments, for which clear and consistent targets can be set. In addition, STECF suggests that in addition to using biological reference points as indicators for management, additional emphasis should be placed on utilising indicators such as capacity utilisation of the fleet (number of sea days per year deployed per fleet segment in proportion to the maximum number of sea days) and economic indicators such as operating profit margin (net profit relative to gross revenue) or return on capital i.e. profit before interest and depreciation relative to invested capital. Further indicators could be considered e.g. resource rent at the optimum level, break-even revenue in proportion to current revenue. All of these indicators will assist in defining what is meant by balance between resources and exploitation and in defining objectives for management.

With clearly stated objectives, fisheries scientists and economists will then be able to evaluate the effects of different management measures that are designed to achieve those objectives and advise on the biological and economic consequences of such measures.

# 7 ECOSYSTEM APPROACH

## 7.1 BY-CATCH OF SEA TURTLES IN EU LONG LINE FISHERIES.

STECF was asked the following:

To review, comment as appropriate and endorse the report prepared by SGRST/SGFEN 05-01 (4-8 July 2005) on this matter, which (a) summarised EU drifting long-line fisheries, (b) assessed the known by-catch of turtles, (c) reviewed data from national rescue centres and (d) assessed knowledge on effectiveness of mitigation measures.

## 7.1.1 STECF observations and comments

STECF reviewed the report prepared by SGRST/SGFEN 05-01, noting that to collate most of the available information on these issues was a significant task which was further hampered by the unavailability of some experts to attend the meeting As a consequence, most of the information provided by the SGRST/SGFEN report were related to the Mediterranean Sea, resulting in an incomplete and regionalized overview of the EU drifting long-line fleets activities and their turtle by-catch. It is desirable that scientists with a good knowledge of drifting long-line fisheries in distant waters should be convened to fill the existing gaps in our knowledge of these fisheries.

STECF notes that several EU drifting long-line vessels usually fish in areas where important concentration of marine turtle species are known to occur.

STECF notes that worldwide, seven marine turtle species, Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricate*), Kemp's Ridley (*Lepidochelys kempi*), Olive Ridley (*Lepidochelys olivacea*), Flatback (*Natator depressus*) and Leatherback (*Dermochelys coriacea*), are likely to be impacted by the EU drifting long-line fleets..

STECF further notes the difficulties encountered in obtaining good descriptions of the EU drifting long-line fleets operating that currently operate in the various fisheries worldwide. A major problem is the inability to obtain information on multipurpose licences that exist in several EU Member States. A similar problem also exists even in international fishery commissions such as ICCAT, where a register of vessels has been already established, but where there is no obligation to specify the fishing gear used. The present EU Data Collection Regulation (EC Reg. 1543/2000) is inadequate to provide this type of information by *metier*. As a result, SGRST/SGFEN was unable to provide a general figure of the EU drifting long-line fleet as a whole, although information from some EU countries, where data has been obtained from specific research projects was relatively comprehensive.

STECF notes that the SGRST/SGRN report provides a useful list of bilateral drifting longline agreements between the EU and several other countries for the Atlantic Ocean, the Indian Ocean and the Pacific Ocean. At the same time, STECF shares the concern by SGRST/SGFEN regarding the fact that no data and information from such fisheries was available to the subgroup.

STECF notes that the information collated by the Sub-group indicates the large variability of the by-catch rates of marine turtles by sea area and time. However, since the available information not extensive, together with the scant information about the life cycle of the most frequent turtle species encountered, the scope to clearly identify the likely "hot spots" for marine turtle by-catch is rather limited.

On this last issue, STECF notes that of the 18 research projects carried out in various EU countries, most of the research effort (11+1) was concentrated in the Mediterranean Sea, the majority of the EU funded projects were co-funded by DG Environment (7), while only one was co-funded by DG FISH. This may explain the limited attention given to the fisheries concerned and the limited spatial coverage of some projects. In addition, while several research projects are still on-going, SGRST/SGFEN found that some experiments on mitigation approaches have

been conducted with inappropriate methodologies and as a consequence, their results are not conclusive with regard to their utility and potential effectiveness in mitigating turtle by-catch in the long-line fisheries (e.g.: bait colour, lures, etc.).

STECF notes that although information at present is incomplete, several stranding networks and rescue centres are active in EU countries. These activities should be able to provide useful additional information on marine turtles, particularly on the incidental effects of various fishing gears, including surface drifting long-lines. Rescue centres are a very good source of detailed information about the possibility for a turtle to survive after hooking. Rescue centres are also able to increase the survival rate of hooked marine turtles, but their effects on the turtle populations as a whole, are unknown.

Regarding trials on mitigation approaches by using circle hooks, the US investigations in the Pacific and the western Atlantic have suggested that the use G-shaped hooks (= circle hooks) above a certain size reduce the by-catches compared to by-catches in fisheries using the traditional Jj-shaped hooks. On basis of the results from the Grand Bank trials, FAO concluded in 2004 that: "(the use of) circle hooks reduce catches of sea turtles (compared to J-hooks)".

However, it also appears that the hook-shape and size based mitigation effects do not seem to be the same for all marine turtle species. Furthermore, the bait species and size also appear to have an influence the by-catch. Another broad overview, recently concluded that the overall effect of circle hooks in reducing by-catch is largely limited to the soft-shelled leatherback turtle.

The main conclusions of the available knowledge on these issues, examined by SGRST/SGFEN, are the followings:

- 1. circle hooks reduce the catch rate of leatherback turtles and hard-shelled turtles, but the effect of bait type and size has not been evaluated.
- 2. mostly because of mouth size, catch rates of hard-shelled turtles is probably reduced by large hooks, i.e. it is the size of the hooks rather than the shape which influences the by-catch rate of hard-shelled turtles.
- 3. Experiments have been limited so far only to a very few fisheries and target species; the extrapolation of these preliminary results to all pelagic drifting long-line fisheries is not appropriate.
- 4. The are indications from experiments that changing from J to Circle hooks may in some instances increase the by-catch of some shark species.

The available data about the effects of different bait species and their size are confounded by the effects of different hook size and design. However, from the experiments in the northwest Atlantic, it seems that when using J-hooks switching from using squid to mackerel as bait, reduces the by-catch of both loggerheads and leatherbacks in pelagic drifting long-lines. Change in bait type could affect some specific fisheries. The bait size is another important factor to be taken into account, but this information is often not available.

STECF notes that its previous opinion on the use of different circle hooks and baits, reported on SEC(2005)369, is still valid and the consideration reported there can be retained.

Trials on mitigation approaches using circle hooks or by setting lines deeper in the water column are currently ongoing. However STECF shares the view of SGRST/SGFEN's, that further research is still required to better assess the biological and economical effects of a change in fishing technique or fishing strategy on either target species or other species like sharks.

# **7.1.2 STECF Recommendations**

Due to the importance of the drifting long-line fisheries for the EU fishery, STECF makes the following **recommendations:** 

In view of the implementation of an ecosystem approach to fishery management, the revised Data Collection Regulation, should include the mandatory collection of by-catch data on marine turtles (and other protected species) by observers on board.

In future, drifting long-line fisheries should be properly described according to a more appropriate fleet segmentation is required in the revised Data Collection Regulation; basic data on fleets, by gear type and area, should be collected and available for use by STECF or other appropriate bodies. CPUE data from the drifting long-line fishery in all oceans should be collected according to international standards (e.g. ICCAT methodologies); therefore, the EC Data Collection Regulation should be adapted accordingly.

EU drifting long-line fleets fishing under EU Bilateral Agreements worldwide, should provide information about their fishing activities and the turtle (and other species) by-catch. Their activity should be properly monitored by on-board observersd, particularly during at least the first year of activity in a newly exploited area. This information should be made available to STECF when necessary.

Co-operation among EU scientist working on marine turtle conservation and fisheries should be encouraged, with the purpose to standardised data collection, by using agreed protocols. Participation of EU experts in international commissions dealing with these issues should be also encouraged and supported.

Co-funded EC projects and activities dealing with the drifting long-line fishery and the marine turtle by-catch should provide data when specifically requested by STECF, even in a provisional format. These projects should be conducted following scientific methodologies and properly taking into account the scientific literature.

Data from turtle rescue centres should be annually reported to EU Member States and made available to the EC when necessary.

Further monitoring of EU drifting long-line fisheries worldwide is needed to better assess marine turtle by-catch and population mortality. Research should be carried out over large areas and for consecutive years, in an attempt to identify areas and periods when by-catch rates are significant.

Research on possible mitigation measures regarding marine turtle by-catch in drifting long-line fisheries targeting various species, directly tested at sea, should be further encouraged. Such research should involve collaboration between different countries and cover large geographical areas. Research data should provide a comprehensive overview of the catch, including all fish and other species, and detailed technological descriptions of the fishing gears used, setting procedures, hook type and size, and bait type and size.

Research on marine turtle population dynamics, including migrations, concentrations and genetics should be encouraged and these data should be made available to STECF when necessary.

# 7.2 REVISION OF THE DATA COLLECTION REGULATION TO TAKE INTO ACCOUNT THE ECOSYSTEM APPROACH

STECF was asked the following:

STECF should deliver an opinion based on the work done by subgroup SGRN-05-03 which recommended the data could be collected to provide information on (a) the spatial and temporal distribution of different fishing activities (b) trends in fish assemblages. (c) impact of fishing on species that are intentionally exploited and on unintended by catch (d) genetic erosion of commercial wild stocks.

# 7.2.1 Review of SGRN report

A group met under SGRN in July 2005 to address this issue. STECF commends the work of the group and welcomes the report. The group identified and prioritised immediate data and research and development needs to support the integration of environmental protection requirements into the Common Fisheries Policy (CFP), consistent with COM (2002) 185 final and COM (2002) 186 final.

## 7.2.2 STECF comments and recommendations

STECF draws the following summary from the report:

1. The most rapid and cost-effective progress towards environmental integration is expected to be achieved by the modification and/or development of existing data collection methods, coupled with the introduction of methods not in the existing data collection programme when modification and/or development is not possible.

- 2. Data are required to support rational and evidence-based decision making. Data needs will depend on the choice of management system that is used to achieve environmental integration. In proposing data needs, the report assumes that management will be guided by indicators, with indicators selected and prioritised to support management of those fishing effects most likely to compromise environmental integration. Data collection requirements follow from the necessity to support the calculation and reporting of indicators.
- 3. STECF recommends that two types of indicator are needed to support the environmental integration process, indicators of the state of the marine environment and indicators of the pressure that affects state. Understanding and predicting the links between pressure and state is essential if managers are to modify pressure (e.g. manage fishing) to achieve desired states. Pressure may come from sources not directly anthropogenic.
- 4. STECF recommends classes of indicator for immediate application. These indicators were selected because they would assist with the management of fishing effects most likely to compromise sustainability. These indicators meet previously published criteria. Although an absence of data prevented the application of the indicators.
- 5. The state indicators recommended by SGRN for immediate application were (1) Abundance of vulnerable fished species and/ or (trends?) in their conservation status in relation to International Union for the Conservation of Nature (IUCN), or other appropriate, but yet to be identified criteria, (2) Abundance of vulnerable marine mammals, reptiles and seabirds, (3) Mean size and mean maximum sizes of bottom dwelling fishes, (4) Proportion of sensitive habitats impacted/ protected, (5) Abundance of rare or vulnerable species or habitats and (6) Age and size of maturity of abundant and/ or commercially targeted species. Within regions, the detailed specification for each indicator would depend on the population, species, community or habitat of regional relevance. The associated pressure indicators were (1) spatial and temporal distribution of fishing effort and (2) catch and discard rates, with their specifications dependent on the state indicators (as listed above).

STECF notes the use of the IUCN criteria alone may be not be appropriate for all marine species.

STECF further notes that the following definitions apply to the indicators listed above:

**Vulnerable** - species which show a greater than average (or some other specified point on a distribution) reduction in population size for a given rate of mortality (or other pressure)

**Mean maximum size** (of a community) -  $\overline{L_{\max}} = \sum (L_{\max_j} N_j) / N$ 

or equivalent for weight where  $L_{\max j}$  is the maximum length obtained by species j (Linf is often used), and N is the number of individuals of species j.

**Sensitive habitats**- habitats which show a greater than average (or some other specified point on a distribution) rate of degradation in response to a given pressure. It can be considered as the index  $1-e^{-R}$  where R is recovery time to 90% of unimpacted biomass, production or other metric.

**Rare**- species that meet some specified criteria for rarity, such as adult numbers of species j as a proportion of adult numbers of all species or percentage coverage of habitat type j as proportion of coverage of all habitat types.

**Special interest**- of concern to some interest group- be it Government, NGOs, fishermen etc

6. Data requirements to support the (state) indicators were: (1) Identification and quantification of species that are sampled using standard survey methodologies but not systematically recorded, (2) Identification. quantification and ageing of species that are currently sampled and contribute substantially to community biomass or production, (3) Records of species of special interest, (4) Acoustic survey records of specific habitats, (5) Monitoring of relative abundance and distribution of cetaceans, seabirds and reptiles and (6) Sampling benthos. The report identifies how progress with collecting these data could be made in the short term by modifying and SGRN developing existing data collection activities. In addition, recommended that bottom temperature and salinity data should be routinely collected on bottom trawl surveys.

STECF interprets "species of special interest" as those covered by habitat directives and international conventions. STECF considers that the data requirement to sample benthos means the identification and monitoring of benthic communities particularly affected by fishing activities. STECF notes that water column temperatures are also collected during other types of survey.

- 7. Changes to existing data collection procedures are needed to provide fishing effort, catch and discard data to calculate pressure indicators and to support environmental integration. To support environmental integration, VMS data must be freely available for analysis. One of the greatest impediments to progressing current studies of the environmental effects of fishing, and to linking pressure and state indicators, is the non availability of international VMS data. STECF notes, that considering that many stocks are exploited by more than one member state, access to the disaggregated VMS data is crucial for technical analysis of fleet behaviour. The requirement for VMS data and catch and bycatch data, that are the focus of state indicators, will be common to all regions. Thus access to VMS data and collation of international VMS data should be pursued at the pan-(european) scale while catch and discard monitoring will be adjusted regionally following identification of state indicators.
- 8. Regional representation at SGRN was not comprehensive and it was considered premature to make firm proposals for all regional data collection activities. However, experts from some areas (Mediterranean, Baltic Sea, North Sea, Eastern Channel and Area II) were present and they have put forward proposals for regional data collection activities based on their own experience. STECF considers these proposals are only an initial step as the regional representation at the SGRN meeting was poor, hence more effort and work on the regional context needs to take place.
- 9. In most regions, the data requirements to support environmental integration could not be sufficiently refined to make immediate recommendations for a new data regulation. However, changes to the existing regulation could be proposed in the short-term at the regional scale. For surveys, SGRN recommends that this should be done through regional co-ordinating groups.
- 10. STECF considers that developments are required in four areas to support immediate progress towards environmental integration: (1) to modify and improve research vessel survey design to provide appropriate data to support the state indicators, (2) to collect appropriate catch, discard and fishing effort data to support the pressure indicators and to modify and develop procedures for collation and analysis, (3) to establish links between proposed state and pressure indicators that might be used to manage fisheries and (4) to map habitats to allow an assessment of fishery-habitat interactions.

11. SGRN focused on immediate data needs to support the environmental integration process in the short-term. In the medium-term, however, STECF emphasised that a fully developed ecosystem approach has to take account both of the effects of fishing on the environment and the effects of the environment on fisheries. In the medium term, any data regulation should evolve and adapt in response to accumulated knowledge. Examples of such data are those that help describe changes in productivity or interactions among species.

STECF notes that the SGRN report often refers to the INDENT and INDECO projects, and would like to be kept informed as to the results of the projects. STECF recommends that the Commission also considers input from other projects currently running on the use of indicators within the ecosystem approach. STECF Working Group Anchovy

Brussels, 11-13 July 2005

# APPENDIX 1 THE FRENCH ANCHOVY FISHING FLEET – AREA VIII STRUCTURE, RECENT TRENDS AND PRELIMINARY ANALYSIS OF THE POTENTIAL IMPACT OF A FISHERY BAN ON THE FISHING FLEETS

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## INTRODUCTION

The objectives of the paper are twofold; (1) to provide a description of the structure of the fleet and sub-fleets operating in the anchovy fishery in area VIII and their recent evolution between 2000 and 20047; (1) to provide a preliminary analysis the potential consequences of the current fishery ban (3 months) and its extension to 6 or 9 months.

The paper is organised as followed. We first describe the data sets used for this study, the recent trends of the French Anchovy landings being presented in a second step. The structure and evolution of the fleet and sub-fleet leads distinguish the trawlers fleet (pelagic or mixed) from the purse seiners fleet and their distribution per regions and districts, respectively. Key parameters by fleet such as the vessel technical characteristics or crew size are provided. We then discuss the evolution per fleet of the anchovy landings, landings per vessel and prices and the dependency of the vessels to anchovy over the period considered.

A preliminary analysis of the potential impacts of different scenarios bans on the gross revenue of the main fleets is carried out. It considers the anchovy dependency of the main fleets in terms of gross revenue at an annual and a monthly basis and the potential consequences of different scenarios for anchovy bans based on a retrospective analysis the fleets gross revenue. The following assumptions are used. In a first step, the analysis is *static* as fishermen behaviours are not considered. This means that to potential shifts in the fishing effort from the anchovy metiers to others fishing activities during the bans are not taken into account. In a second step, we consider fishermen could be able to switch from the anchovy fishery to a best alternative (*e.g. dynamic behaviour*). A best alternative should be appreciated by taking into account the current management regulations either for quotas or licences or permits. These regulations may limit the possibility set of the vessels. The analysis uses only the four past years for assessing the potential consequences of a ban. The scenarios studied are a 3 months ban, from the 1<sup>st</sup> of July to the end of September, a 6 months ban, from the 1<sup>st</sup> of July to the end of December.

<sup>&</sup>lt;sup>6</sup> The authors are grateful to Ofimer for providing landings information for 2004 and 2005.

<sup>&</sup>lt;sup>7</sup> A comprehensive analysis of the fleet evolution since 1989 was given by Duhamel E., Biseau A., Massé J and H. Villalobos 2004. The French anchovy fishery ICES. Working Group on the assessment of Mackerel, Horse Mackerel, Sardine and Anchovy. Copenhagen, 7-16 September 2004

# MATERIALS

Four data sets are used for this study work; the national vessels register is available since 1990. It gives the technical characteristics of each vessel active in the fleet at the end of each year. The vessel activity database from Ifremer covers the years 2000 to 2004. For each vessel registered in the fleet, a census of the monthly fishing activity is provided with the list of metiers (Berthou and al. 2002). Each metier is defined by the combination of the gear used the species or group of species targeted and the two main fishing areas in which the vessel operates. The other sources of information available at vessel level are; the auction sales giving landings per species in quantity and value and the logbooks dataset providing a declaration by fishermen of the catches per species and effort.

The French anchovy fleet, hereafter the FAF, is identified by crossing systematically the information on the four data sets described before. According to this methodology, a registered vessel belongs to the FAF if it lands at least 1 ton of anchovy reach. Another threshold (50 tons) is used for the pelagic trawler in a second step.

# RECENT TRENDS IN THE FRENCH ANCHOVY LANDINGS IN AREA VIII

The Figure 7-1 shows a significant decline in annual landings in quantity - 53% between 2001 and 2004 - while the demand responded to the shortage in supply, by a more than 130% increase in price. After a fall between 2000, the combined effects of these variations was a slight increased in landing value (+11%) to reach around 25 Millions Euros per year.



# Figure 7-1 Evolution of landings in quantity, value and average price (constant Euros)

Source: DPMA - Ifremer (Fishery Observatory of Ifremer) - Ofimer

This recent evolution in price can be compared to the prices in the 90s. Anchovy annual prices remained quite stable with an average price around 1.6 Euros/kg over the period. A preliminary statistical analysis of the French price flexibility to change in anchovy supply in area VIII is given in annex.

## Description of the anchovy fleet and its evolution between 2000 and 2004

The description of the fleet is based on a fleet segmentation depending on the gear used for anchovy catches: purse seine or pelagic<sup>8</sup> trawl (single or pair). In 2003, the FA fleet was composed by 104 vessels: 75 trawlers and 29 purse seiners. Trawlers using exclusively pelagic trawl during the year are predominant (46 vessels) but anchovy is also targeted by French mixed or other trawlers (29 vessels which combine during the year pelagic trawl with bottom trawl or other mobile gears such as dredge).

## Table 7-1. The French Anchovy Fleet (vessels landing at least 1 ton of anchovy)

<sup>&</sup>lt;sup>8</sup> Mid water trawl

Years/Fleets	Pelagic Traw lers	Other Traw lers	Mixed Traw lers*	Total Traw I*	Purse Seiners	Total Fleet
2000	62	7	45	114	32	146
2001	57	9	34	100	35	135
2002	52	5	21	78	31	109
2003	46	4	25	75	29	104

Source: DPMA - Ifremer (Fishery Observatory of Ifremer)

A large majority of vessels (95 to 100%) come from the Bay of Biscay harbours, from Southern Brittany to the Aquitaine region.

# The pelagic trawl fleet

By pelagic trawl fleet, we mean the vessels using exclusively mid water trawl during the year. In 2003, the French anchovy pelagic trawl fleet is mostly concentrated in the Pays de Loire's region (Saint Nazaire and Les Sables d'Olonne harbours). There is a strong decrease in terms of number of vessels between 2000 and 2003 (no vessel from this category left in Bayonne in 2003).

Table 7-2 : The French anchovy pelagic trawl fleet (vessels landing at least 1 ton of anchovy)

Pelagic Trawlers	Pays de Loire	Aquitaine	Other	Total Fleet
2003				
Number of vessel	44	0	2	46
Average length (m.)	19,1		-	19,2
Average GRT	54		-	56
Average kW	338		-	340
Number of fishermen	255		-	267
Average crew	6		-	6
2000				
Number of vessel	55	4	3	62
Average length (m.)	19,3	20,1	-	19,3
Average GRT	53	65	-	54
Average kW	342	307	-	342
Number of fishermen	318	20	-	353
Average crew	6	5	-	6

Source: DPMA - Ifremer (Fishery Observatory of Ifremer)

The average vessel is 19 meters long, 56 GRT and 340 kW with 6 fishermen on board. These characteristics remain stable between 2000 and 2003. The number of fishermen involved in this fleet decreased by 30% (from 342 to 267 fishermen), due to the decrease in the number of vessels.

# The mixed and other trawl fleet

This fleet is represented all along the Atlantic coast from South Brittany to Aquitaine ports. It contains vessels using during the year pelagic trawl in combination with bottom trawl and/or other mobile gears, such as dredge. A strong decrease is observed between 2000 and 2003 mainly in Lorient and Les Sables d'Olonnes ports. In the Pays de Loire region, the remaining vessels are bigger, leading to an increase of the average characteristics of vessel during the period.

Table 7-3 : The French anchovy mixed and other trawl fleet (vessels landing at least 1 ton of anchovy)

Mixed and other trawlers	South Brittany	Pays de Loire	Aquitaine	Other	Total Fleet
2003					
Number of vessel	8	15	5	1	29
Average length (m.)	16,58	17,30	20,70	-	17,59
Average GRT	45	52	69	-	52
Average kW	282	295	375	-	303

Number of fishermen	43	78	25	-	149
Average crew	5	5	5	-	5
2000					
Number of vessel	19	24	5	3	52
Average length (m.)	15,75	14,17	20,72	-	15,50
Average GRT	36	33	65	-	38
Average kW	255	237	375	-	260
Number of fishermen	89	86	24	-	214
Average crew	5	4	5	-	4

Source: DPMA - Ifremer (Fishery Observatory of Ifremer)

The average vessel is now less than 18 meters long, 52 GRT, 303 kW with 5 fishermen on board. In 2003, the fleet is composed by around 150 fishermen.

# The French anchovy purse seine fleet

The purse seine fleet is composed by 29 vessels in 2003, mainly coming from South Brittany (Le Guilvinec and Concarneau are the mains ports) and Aquitaine (Bayonne). The average vessel is around 15 meters long, 28 GRT and 187 kW. The fleet has slightly decreased between 2000 and 2003 with different tendencies between regions: a slight increase in the South Brittany and a strong decrease in Bayonne. Around 180 fishermen are now involved in this fleet.

Table 7-4. The French anchovy purse seine fleet (vessels landing at least 1 ton of anchovy)

Purse-seiners	South Brittany	Aquitaine	Other	Total Fleet
2003				
Number of vessel	20	8	1	29
Average length (m.)	15,4	14,1	-	14,9
Average GRT	31	22	-	28
Average kW	197	169	-	187
Number of fishermen	137	39	-	179
Average crew	7	5	-	6
2000				
Number of vessel	17	14	1	32
Average length (m.)	15,3	15,6	-	15,4
Average GRT	31	33	-	32
Average kW	202	178	-	190
Number of fishermen	94	72	-	169
Average crew	6	5	-	5

Source: DPMA - Ifremer (Fishery Observatory of Ifremer)

Since 2000, the FA fleet has decreased by 30% in total, mostly due to the decline in the trawler fleet. The decrease in the fleet is mainly observed in:

- Pays de Loire (Les Sables d'Olonnes) and South Brittany (Lorient and Auray) for the mixed trawlers;
- Bayonne and Saint Nazaire's maritime quarters for the pelagic trawlers;
- Aquitaine (Bayonne) for the purse seiners

The FA fleet is defined by taking into account the vessels landing at least 1 ton of anchovy per year. The trends observed among this fleet can be compared to the trend of the rest of Bay of Biscay pelagic fleet (trawl and purse seine) not targeting anchovy. We mean all the vessels using pelagic trawl or purse seine at least one month during a given year.

	Exclusive				
Year/Fleets	pelagic traw ler	Mixed traw ler	Other traw I	Total Traw lers	Purse Seiners
2000	65	93	3	161	38
2001	61	96	12	169	37
2002	61	100	4	165	36
2003	55	92	7	154	38

Table 7-5 : The Bay of Biscay pelagic trawl and purse seine fleet (vessel potentially able to target anchovy)

Source: DPMA - IFREMER (Fishery Observatory of Ifremer)

Whereas the FA fleet decreases between 2000 et 2003, the Bay of Biscay pelagic trawl and purse seine fleet remains quite stable in the same period. In 2003, the purse seiners are still composed by 38 vessels and the total trawlers targeting pelagic species decrease from 161 to 154 vessels. Faced to the depletion of anchovy, the fishing effort of trawlers seems to have been reported to other targeted species. These reports are not obvious for purse seine fleet. It is interesting to notice that the Bay of Biscay pelagic trawlers are mainly composed by mixed trawlers with opportunistic behaviour more remarkable.

# ANCHOVY LANDINGS AND PRICES PER FLEET

This section provides some indications on the evolution of the anchovy landings for a selection of the mains fleets described before and for the years 2000-2004. The French anchovy production in area VIII is mainly landed by the trawlers fleets. This fleet accounted for 90% of the total landings as reported in the next figure. Within this fleet, the pelagic fleet covered the major part, but with a decreasing share over the period; from 90% in 1990 to 74% in 2004. The landings of the mixed trawlers fleet oscillated between 1500 and 2000 tons with no specific trend. The rest of the production, from 6% to 14% by year, is supplied by the purse seiners fleet divided in two set of vessels, those operating from the Aquitaine region and the Brittany region, respectively<sup>9</sup>. This last fleet landed a significant share of the purse seine landings.

Whatever the vessel length categories, average landings per vessel and per fleet shows heterogeneous evolutions over the period. The average landings of the pelagic trawlers plummeted from 250 to around 110 tons and this declining trend follows the evolution of total production. There is no significant trend for the mixed trawl fleet with around 50 tons per year, except for 2002 (less than 100 tons). The purse seine landings are characterized by a high level of inter-annual variability, especially for the southern Brittany fleet. It ranges from 17 tons per boat in 2001 to more than 100 tons in 2001

Price evolutions per fleet highlight similar and increasing trends except for purse seine fleet of Aquitaine in 2003 and 2004. However, purse seine landings are better valued than the trawlers landings but the gap is not constant. This gap ranges from 0 to 1.4 (kg and this could be explained by the either a different seasonality in landings or a differentiation in landing products.

#### Figure 7-2. Pelagic and mixed trawlers – Annual landings per fleet (in tons) Figure 7-3. Pelagic and mixed trawlers - % of Purse seine landings in total French landings (area VIII)

<sup>&</sup>lt;sup>9</sup> Less than 5% of the production is landing by the other fleets described before.





Average anchovy landings per vessel and Average prices per fleet (Euros/kg) per fleet (in tons)

Figure 7-4. Pelagic and mixed trawlers - Figure 7-5. Pelagic and mixed trawlers -



Source: DPMA - Ifremer (Fishery Observatory of Ifremer) - Ofimer Figure 7-6. Purse seiners - Annual landings Figure 7-7. Purse seiners - % of Purse seine



landings in total French landings (area VIII)



Figure 7-8. Purse anchovy landings per vessel and per fleet per fleet (Euros/kg) (in tons)

seiners - Average Figure 7-9. Purse seiners - Average prices



Source: DPMA - Ifremer (Fishery Observatory of Ifremer) - Ofimer

Figure 7-10 shows the monthly trends in landings and price. Price soared in June with around  $10 \notin \log$  just before the ban of the fishery.

Figure 7-10. Monthly price and landings (January 2004 to June 2005)



Source: Ofimer

# A PRELIMINARY ANALYSIS OF THE POTENTIAL IMPACTS OF DIFFERENT SCENARIOS BANS ON THE GROSS REVENUE OF THE MAIN FLEETS.

As seen previously, the level of activity of the vessels into the anchovy fishery is characterised by significant changes at an annual scale (see also, Duhamel et al. WD 2004). The following analysis considers the dependency of the main fleets in terms of gross revenue at an annual and a monthly basis and the potential consequences of different scenarios for anchovy bans based on a retrospective analysis the fleets gross revenue.

## Assumptions

In a first step, the analysis is **static** as fishermen behaviours are not considered. This means that to potential shifts in the fishing effort from the anchovy metiers to others fishing activities during the bans are not taken into account. In a second step, we consider fishermen could be able to switch from the anchovy fishery to the best alternative (*e.g. dynamic behaviour*). The best alternative should be appreciated by taking into account the current management regulations either for quotas or licences or permits. These regulations may limit the possibility set of the vessels and other management regulations like compensation for staying in the harbours have to be considered. The analysis uses only the past years for assessing the potential consequences of a ban.

# Scenarios:

- A **3 months ban**, from the 1st of July to the end of September *(referred as 2 in the figures).*
- A **6 months ban**, from the 1st of July to the end of December (referred as 3 in the figures).
- A **9 month ban**, from the 1st of January to the end of March, then from the 1st of July to the end of December (*referred as 4 in the figures*).

The analysis is carried out over the 2000-2003 period and for each year according to the following methodology.

# Indicators:

Different indicators, calculated for each fleet or sub-fleet, deal with the economic weight of anchovy in gross revenue:

- The share of anchovy annual revenue in the total annual revenue of each fleet (referred as A.R/T.R. in the figures)
- The share of anchovy revenue over each ban period in the annual anchovy revenue
- The share of anchovy revenue in total gross revenue over each ban period
- The average annual revenue per vessel
- The number of vessels involved in each fleet or sub-fleet
- The average monthly gross revenue per vessel and per species

In principle, more informative economic indicators would include *inter alia* gross surplus, net profit and wages.

# Application to the main different fleets

The analysis could be carried out at different fleet levels but only the mains fleets are included hereafter. The fleets considered are:

- 1. The exclusive pelagic trawlers fleet from the Bay of Biscay districts<sup>10</sup>,
- 2. The subset fleet of exclusive trawlers landings at least 50 tons of anchovy per pair
- 3. The mixed trawlers fleet operating from the Bay of Biscay districts,
- 4. The purse seine fleet operating from the districts belonging the Aquitaine region
- 5. The purse seine fleet operating from the districts belonging to the Brittany region

The degree of dependency to anchovy at an annual level was very different according to the fleets over the considered period.

## 1. The exclusive pelagic trawlers fleet from the Bay of Biscay districts $^{11}$ ,

The Exclusive pelagic trawlers fleet was the most dependent, with on an average basis, 50% to 60% of the total annual gross revenue coming from the anchovy landings (see figure 11). This dependency may be higher for specific vessels. The average revenue per vessel was quite stable, between 700 k $\in$  and 800 k $\in$ , and the number of vessels declined over the period (51 to 43 vessels).

From year to year, the share of anchovy revenue in the annual anchovy revenue ranged from 38% to 51% (3 months ban), 52% to 86% (6 months ban), 86% to 93% (9 months ban). The

<sup>&</sup>lt;sup>10</sup> Few vessels operate from Channel districts

<sup>&</sup>lt;sup>11</sup> Few vessels operate from the Channel districts

share of anchovy revenue in total gross revenue over each ban period ranged from 53% to 77% (3 months ban), 49% to 79% (6 months ban), 54% to 65% (9 months ban)

The other main species in value landed over the years were European sea-bass, horse mackerel and albacore and the evolution per year of the monthly revenues per vessel is described in annex.

# Figure 7-11. Pelagic trawl fleet - share of anchovy annual revenue in the total annual revenue - Share of anchovy revenue in total gross revenue over each ban period

Figure 7-12. Pelagic trawl fleet -Share of anchovy revenue in total gross revenue over each ban period



Figure 7-13. Pelagic trawl fleet average annual revenue per vessel -Number of vessels involved





Figure 7-14. Pelagic trawl fleet – Sensitivity of average gross revenue to different ban scenarios



Source: Ifremer

# 2. Pelagic trawlers (>50 tons per pair): A preliminary analysis of the potential report of fishing effort to alternative fisheries

We first selected the population of trawlers using pelagic trawl from the bay of Biscay harbours and we identified two subsets of vessels; The pelagic pair trawlers landing at least 50 tons of anchovy per year and per pair, and the mixed trawlers not targeting anchovy but using mid water trawl and bottom trawl. These two subsets of vessels are comparable in terms of technical characteristics, and their size gives them the possibility to target species in different fishing areas (Ices area VIII and VII). We assume at this stage that the switch from the pelagic trawler fleet to the mixed trawl fleet is the easiest alternative in terms of fishing activity but other catch possibilities should have to be considered<sup>12</sup>.

Figure 7-15 and Figure 7-16 present for 2003, the compared monthly evolution of total and per species gross revenue, respectively. The main differences in gross revenue occurred from June to November when the pelagic trawlers were operating in the anchovy fishery. The landings composition of the mixed trawlers also gives

<sup>&</sup>lt;sup>12</sup> To consider fishing alternatives, the comparison of margin on variable costs should be considered in order to include the difference in variable costs from a metier to another. We assume here, variable costs of these fleets are homogeneous

indications on the target species; albacore from august to October, Norway lobster and Anglerfish mainly between April and July, Sea Bass for some vessels at the beginning of the year, Hake and Sole, etc.

# Figure 7-15. Average revenue of pelagic trawlers (>50 tons per pair) and mixed trawlers of the bay of biscay not targeting anchovy in 2003



Source: Ifremer

Figure 7-16. Pelagic trawl fleet (50tons) - Average revenue per month and per species in 2003





## Source: Ifremer

A re-allocation of effort to these species should be considered optimistic since crewing effects, licensing and quota restrictions for other species, price effects, etc, have to be taken into account in the predictions.

For example, entering the albacore or the Norway lobster fisheries is subject to licence or fishing permit holding. Fleets targeting anchovy do not necessarily have the right to enter these fisheries and to catch these species. As underlined in the next table, the consumption rates of national quotas for the main species have increased over the last years either in area VIII or VII. These levels rise from around 70% in 1998 to 99% in 2003, for the three main species in area VIII. Rates of consumption reached high levels in 2003 for in area VII, except for species like Norway lobster and megrims. The TAC for albacore was not fully consumed before 2004. As a consequence, the capacity for the fleet studied to switch to other species is in many case limited by the levels of the TAC constraints and potentially by the individual fishing vessels rights when there are allocated in P.O.'s.

# Table 7-6 Levels of French Quotas after exchanges, and Rate of Consumptions for Ices area VIII\*

National Que	ota (in	1995	1996	1997	1998	1999	2000	2001	2002	2003
tons)										
Norway lobster		6390	6390	6390	5170	5170	4205	3790	3058	2870
Anglerfishes				6470	6470	6470	5893	5253	4804	3304
Common sole		6050	5590	5055	5500	4955	5810	5762	3690	3483
European hake		14250	13210	15540	14980	13850	7880	4576	6467	7453
Megrim		1280	947	1148	1013	993	757	498	553	539
National	Quota	1995	1996	1997	1998	1999	2000	2001	2002	2003
<b>Consumption</b> (	in %)									

Norway lobster	71.9	71.2	56.2	68.6	59.6	70.9	90.3	99.3	98.9
Anglerfishes			83.2	66.3	50.9	46.8	51.6	81.7	99.8
Common sole	87.0	74.8	89.3	70.7	66.8	91.3	79.5	99.3	99.2
European hake	81.4	49.1	44.3	31.4	32.9	71.1	64.5	69.9	75.4
Megrims	110.4	96.7	97.3	80.4	85.6	61.6	45.6	63.5	65.0

\* Hake TAC for areas VIIIa),b),d),e) and Vb), VI, VII, XII, XIV

Source: TECTAC-manenq data base

# Table 7-7 Levels of French Quotas after exchanges, and Rate of Consumptions for Albacore

Albacore	2001	2002	2003
TAC (in tons)	7010	5599	6259
TAC Consumption (in	88.1	76.2	46.8

Source: TECTAC-manenq data base

# Table 7-8 Levels of French Quotas after exchanges, and Rate of Consumptions for Ices area VII\*\*

National Q	Juota	(in	1995	1996	1997	1998	1999	2000	2001	2002	2003
tons)	-	•									
Anglerfishes			10670	13960	14925	14637	14331	13038	11583	9924	9603
Norway lobste	er		5590	5590	5590	5590	5590	5105	4595	4961	4326
Atlantic cod			12990	15280	15272	15100	14250	11820	7449	6563	5043
Megrims			7280	6930	7650	8150	8965	7335	3786	3367	3076
Whiting			18600	16800	16564	17390	16593	15122	14101	19020	18920
National	Q	uota	1995	1996	1997	1998	1999	2000	2001	2002	2003
consumption	1 (in %)										
Anglerfishes			94.0	92.6	71.1	65.5	59.0	51.3	64.7	100.8	96.2
Norway lobsto	er		91.1	77.0	63.8	55.7	51.0	61.9	67.7	84.4	85.1
Atlantic cod			104.7	88.0	100.7	91.0	83.4	66.9	98.2	99.8	99.1*
Whiting			98.5	91.8	100.0	98.6	100.6	99.8	96.0	66.0	64.9
Megrims			40.2	49.6	41.2	37.2	30.8	37.9	41.5	69.9	86.1

\*\* Cod TAC for areas VIIb),c),d),e),f),g),h),j),k),VIII,IX,X;COPACE 34.1.1 (1)

Source : TECTAC-manenq data base in Guyader et al. (2005)

This preliminary study does not consider the price effects of change in the supplies of species in the case of a reallocation of effort to these species. The expected changes in gross revenues of the fleets studied but also of the other fleets targeting these species have to be studied. Long term stock effects of changes in fishing mortality are not considered here.

Based on the assumptions discussed previously, the preliminary analysis of the different management scenarios gives the following impact on the average gross revenue of the fleet targeting anchovy (Figure 7-18). The overall results for a closure in 2003 indicates that cessation of all fishing activity for the trawler fleet targeting anchovy would lead to losses in gross revenue ranging from 40% - 80% depending on the length of closure. Continuing to fish for species other than anchovy but maintaining their base-line activity would result in losses of 55%. Maximising their potential revenue by targeting species other than anchovy with bottom trawl would result in losses in the region of 20% in the case of the most optimistic scenario.

# Figure 7-18. Sensitivity analysis of gross revenue to different bans scenarios and to different assumptions regarding fishermen behaviour (reference 2003)


#### 3. The mixed trawlers fleet operating from the Bay of Biscay districts.

The rising level of dependency for the trawlers, from around 15% to 35% of the gross revenue between 2000 and 2003 may be explained by the reduction of the fleet size. The remaining vessels probably target more anchovy than the fleet on average in 2000.

From year to year, the share of anchovy revenue in the annual anchovy revenue ranged from 36% to 49% (3 months ban), 51% to 85% (6 months ban), 85% to 95% (9 months ban). These figures are very similar to the figures for the exclusive pelagic trawlers because they used the same gear. The share of anchovy revenue in total gross revenue over each ban period ranged from 21% to 53% (3 months ban), 15% to 51% (6 months ban), 18% to 43% (9 months ban)

The other main species in value landed over the years were Norway lobster, Albacore, European sea-bass and the evolution per year of the monthly revenues per vessel is described in annex.

The analysis of fishing effort re-allocation to other fisheries is not considered hereafter.

#### Figure 7-19. Mixed trawl fleet - share of anchovy annual revenue in the total annual revenue - Share of anchovy revenue in total gross revenue over each ban period

#### Figure 7-20. Mixed trawl fleet - Share of anchovy revenue in total gross revenue over each ban period









Source: Ifremer

# 4. The purse seine fleet operating from the districts belonging the Aquitaine Region

The dependency of this fleet increased over the period, from around 20% until 2002 to around 40% of the annual gross revenue in 2003. With around 150k€ per vessel, the average revenue was quite stable over the years, except for year 2001 (200k€). A significant fall in the number of vessels belonging to the French anchovy fleet, from 14 to 8 fishing units, is noticed.

From year to year, the share of anchovy revenue in the annual anchovy revenue was extremely variable. For the 9 months period, this level ranged from 7% in 2003 to 61% in 2002. The share of anchovy revenue in total gross revenue over each ban period ranged from 8% to 25% (3 months ban), from 7% to 22% (6 months ban) and from 5% to 16% (9 months ban). Of course, the decrease in gross revenue could be higher for this fleet if the anchovy harvest are forbidden as bait for the catch of bluefin tuna which represent a significant revenue in summer. In 2004, the monthly gross revenue for anchovy was quite similar (in value and over the months) to the year 2003. The anchovy gross revenue is, however, very low for the first six months of 2005.

The other main species landed by this fleet were, in decreasing value, Horse mackerel, Bluefin tuna, European pilchard. The evolution per year of the monthly revenues per vessel is described in annex.

The analysis of fishing effort re-allocation to other fisheries is not considered hereafter.







Figure 7-25. Purse seine fleet (Aquitaine) - average annual revenue per vessel - Number of vessels involved Figure 7-26. Purse seine fleet (Aquitaine) - Sensitivity of gross revenue to different bans scenarios (no report in fishing effort)



Source : DPMA-Ifremer

# 5 The purse seine fleet operating from the districts belonging the Brittany region

The dependency of this fleet fell over the period, especially in 2002 and 2003 (around 12% compared to 25% in 2000 and 2001). The average revenue per vessel increased significantly, from 400k€ in 2000 to around 500k€ and soared to 600k in 2002. Three vessels entered the anchovy fleet between 2000 and 2001.

This fleet landed most of the anchovy in the second semester for the four years studied. Within the period covering the month from July to September, the minimum (53%) and the maximum (75%) of the annual anchovy landings were reached in 2003 and 2001, respectively. Almost all the landings were sold between July and December (94% in 2003 and 100% for the other years). Over this period, anchovy accounted for around 35% of the total landing value in 2000 and 2001 and less than 20% in 2002 and 2003. However, very high landings in value were registered in 2004, especially in August and this change has probably increased the level of anchovy in the total revenue of this fleet.

The other main species landed by this fleet were, in decreasing value, European pilchard, Horse mackerel and Atlantic mackerel.

The analysis of fishing effort re-allocation to other fisheries is not considered hereafter.

Figure 7-27. Purse seine fleet (Brittany) - share of anchovy annual revenue in the total annual revenue - Share of anchovy revenue in total gross revenue over each ban period Figure 7-28. Purse seine fleet (Brittany) - Share of anchovy revenue in total gross revenue over each ban period



Figure 7-29. Purse seine fleet Figure (Brittany) - average annual revenue (Brittan per vessel - Number of vessels differen involved gross r

Figure 7-30. Purse seine fleet (Brittany) - Sensitivity analysis of different fisheries bans on average gross revenue (no report in fishing effort)



Source : DPMA-Ifremer

#### ANNEXES

Figure 7-31: Price-Landings relationship for anchovy in area VIII (1990-2005)\*



\* Preliminary results

#### Note : International landings in area VIII, average French annual priceSource: WGMHSA (2004)

Ofimer-DPMA (1990-2005)

Durse seiners		Aquita	ine	Other	Total Float				
Fuise semens	Concarneau	Le Guilvinec	Other	Total	Bayonne	Total	Other	Total Fleet	
2003									
Number of vessel	9	9	2	20	8	8	1	29	
Average length (m.)	15,6	15,5		15,4	14,1	14,1		14,9	
Average GRT	32	32		31	22	22		28	
Average kW	203	196		197	169	169		187	
Number of fishermen	63	61		137	39	39		179	
Average crew	7	7		7	5	5		6	
2000									
Number of vessel	8	6	3	17	14	14	1	32	
Average length (m.)	15,7	15,4		15,3	15,6	15,6		15,4	
Average GRT	36	28		31	33	33		32	
Average kW	221	181		202	178	178		190	
Number of fishermen	34	40		94	72	72		169	
Average crew	4	7		6	5	5		5	

	Pays de Loire			Aquitai	ne			
Pelagic trawlers	Les Sables d'Olonne	Saint Nazaire	Total	Bayonne	Total	Other	Total Fleet	
2003								
Number of vessel	20	24	44			2	46	
Average length (m.)	18,3	19,7	19,1				19,2	
Average GRT	48	59	54				56	
Average kW	308	362	338				340	
Number of fishermen	107	147	255				267	
Average crew	5	6	6				6	
2000								
Number of vessel	25	30	55	4	4	3	62	
Average length (m.)	19,1	19,4	19,3	20,1	20,1		19,3	
Average GRT	51	54	53	65	65		54	
Average kW	329	353	342	307	307		342	
Number of fishermen	141	177	318	20	20		353	
Average crew	6	6	6	5	5		6	

	South Britanny				Pa	Aquitaine			Tota	Total		
Mixed and other trawlers	Auray	Lorient	Other	Total	Les Sables d'Olonne	Saint Nazaire	Total	Bayon- ne	Other	Total	Other	Fleet
2003												
Number of vessel	3	4	1	8	6	9	15	4	1	5	1	29
Average length (m.)	15,9	16,1		16,6	15,3	18,6	17,3	21,9		20,7	14,5	17,6
Average GRT	41	41		45	43	58	52	74		69	34	52
Average kW	267	260		282	230	339	295	395		375	234	303
Number of fishermen	15	21		43	25	53	78	21		25	4	149
Average crew	5	5		5	4	6	5	5		5	4	5
2000												
Number of vessel	2	15	4	19	15	9	24	5		5	2	52
Average length (m.)	15,3	16,5		15,7	12,7	16,6	14,2	20,7		20,7	14,7	15,5
Average GRT	39	39		36	23	51	33	65		65	36	38
Average kW	239	273		255	197	304	237	375		375	252	260
Number of fishermen	9	75		89	46	40	86	24		24	8	214
Average crew	5	5		5	3	4	4	5		5	4	4



Figure 7-32. Pelagic trawl fleet - Figure 7-33. Mixed trawl fleet -

per Average monthly revenue

per

Average

monthly

revenue

Source: DPMA-Ifremer (2000-2003), Ofimer (2004-2005)

Figure 7-34. Purse seine fleet (Aquitaine) – Average monthly revenue per vessel and per species

#### Figure 7-35. Purse seine fleet (Britanny) - Average monthly revenue per vessel and per species



Source: DPMA-Ifremer (2000-2003), Ofimer (2004-2005)

# APPENDIX 2: REVISIONS AND CORRECTIONS TO THE 2005 ICES FORECAST FOR NORTH SEA HADDOCK

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### WORKING GROUP FORECAST AND ACFM CONCLUSIONS

The WG forecast carried out in 2005 attempted to account for the perceived slow growth of the very large 1999 year-class, as well as indications of a different exploitation rate on that year-class. The WG also used results from the thirdquarter Scottish groundfish survey in determining the probable size of the incoming 2005 year-class, which appears to be moderately large. The WG forecast retained the use of a plus-group at age 7: this was incorrect, as the 1999 year-class will reach age 7 in 2006 and a general plus-group mean weight-at-age and exploitation pattern may not be appropriate.

*Recruitment.* The RCT3 program was used to provide a forecast of the abundance of the 2005 year-class, based on the application to the 2005 Scottish third-quarter survey index of the historical relationship between the survey and the WG estimates of recruitment. This forecast was around 30 billion, compared to a recent average of around 3 billion. The estimated 1999 recruitment was 112 billion. Recruitment in subsequent years was taken to be around 10 billion, which is the average of the 5 lowest values between 1992 and 2001.

*Mean weights-at-age*. The WG observed that estimated mean weights-at-age for the 1999 and 2000 year-classes have been low. Figure 1 (from ICES 2005) shows the mean weight-at-age for ages 0–10, along with lines showing  $\pm 2$  standard deviations (s.d.) of these weights. The weights for the 1999 and 2000 year-classes are also shown, and appear to be following the lower s.d. line closely. The WG therefore decided to use the lower s.d. line in determining mean weights-at-age in future years for the 1999 and 2000 year-classes. For other year-classes, a five-year average of mean weights-at-age was used, where this average was calculated using all year-classes *apart* from 1999 and 2000.

*Exploitation.* The exploitation rate for the 1999 year-class also appears to have been low. This is demonstrated in Figure 2, which compares exploitation on the 1999 year-class with that on other recent year-classes. However, the rates converged in 2004 and are now quite similar. The WG decided, on this basis, to assume flat-topped exploitation: that is, future F values for the 1999 year-class would be the same as they were in 2004.

The ACFM Review Group examined the forecast very closely and agreed that it was appropriate. The ACFM catch option table is reproduced in Table 1.

# **ALTERNATIVES**

# **Corrections in spreadsheet implementations**

In order to explore more fully the range of possible options, and to facilitate flexibility, the forecast was implemented in an Excel spreadsheet. In the course of this work, several small errors in the WG forecast were discovered, as well as points where a more scientifically defensible option could have been taken.

The main difference in the spreadsheet implementation is that the plus-group is at age 15, rather than age 7. This allows the weights and exploitation of the 1999 year-class to be considered separately from the rest of the population, as that year-class reaches age 7 and beyond. This is important as general assumptions made for a 7+ group are unlikely to be appropriate for the 1999 year-class at age 7. The other errors are less important – for example, the weights-at-age for discards and bycatch are full 5-year averages, not 5-year average minus the 1999 and 2000 year-classes as stipulated in the text. These smaller errors have been corrected in the spreadsheet.

# Exploitation

The spreadsheet allows the user to choose between five different methods of calculating exploitation, as follows. In addition, it is possible to set bycatch mortality to zero in the years 2006 onwards. This would be appropriate if, as advised by ICES, the small-mesh industrial fishery remains closed.

#### 2004 estimates

In this approach, the 2004 estimates of mortality for each of the catch components (landings, discards, bycatch) are used unchanged throughout the forecast period. This captures the decline in 2004 in bycatch, but also bases the forecast on the mortality estimates about which there is the most uncertainty.

#### 3-year scaled mean adjusted for 1999 year-class (1<sup>st</sup> approach)

Here the basis for the status quo F is a mean of the exploitation pattern over the years 2002–2004, scaled to the level of the last year (i.e. adjusted so that the average over ages 2–4 of the mean exploitation pattern is the same as the average over ages 2–4 of F in 2004). The three-year mean for each age does not include the values for the 1999 year-class. In this first approach, the total F is split up into components (landings, discards, bycatch) on the basis of historical observations of abundance, and then the scaled *status quo* F is calculated for each component separately.

The additional feature in this version is that the 1999 year-class is treated differently. As in the WG approach described above, the future exploitation on this year-class is assumed to remain at the 2004 level for all future years for landings. For discards and bycatch, the exploitation on the 1999 year-class in 2005 is half the 2004 level, while it is zero for 2006 and beyond (this models the reduced discarding observed on sampling trips, and the greatly decreased industrial fishery, in 2005).

#### 3-year scaled mean adjusted for 1999 year-class (2<sup>nd</sup> approach)

This is very similar to the approach described above (Section 3.2.2), except that here the exploitation rate is calculated on the basis of total catch and *then* split into components. This is what the WG did, and leads to small differences in outcomes from that in Section 3.2.2.

#### 3-year unscaled mean

Here a simple 3-year mean of 2002–2004 estimates of fishing mortality is used as the *status quo F*. All available year-classes are included in the calculation of the mean, and the 1999 year-class is treated as a normal cohort.

#### 3-year unscaled mean without 1999 years-class

As above, except the 1999 year-class data are removed from the calculation of the 3-year mean.

### Mean weights-at-age

In order to convert forecasted numbers into a forecasted total catch it is necessary to predict estimates of mean weights at age for the TAC year and if a TAC constraint is used for both intermediate and TAC years. The method commonly used by ICES is to take an average of the previous three years estimates of mean weight at age. This method is appropriate if the mean weight at age has been relatively constant and there are no reasons to expect future weights to differ from a three year mean.

The haddock 1999 yearclass has so far been observed as one of the slowest growing year-classes since 1963. This means that it may not be appropriate to predict weights at age for 2005 and 2006 (i.e. age 6 and age 7 weights for the 1999 yearclass) by taking an average of the previous three years. The spreadsheet implementation includes four options for forecasting weights-at-age, as follows.

#### 3-year mean for all components

Here a simple 3-year mean of 2002–2004 estimates of weights-at-age is used for the forecast. All available year-classes are included in the calculation of the mean, and the 1999 year-class is treated as a normal cohort.

#### Slow-growing 1999 year-class for all components

Weights-at-age derived from market and observer sampling (Figure 1) show that the 1999 and 2000 year-classes appear to be slow-growing. Furthermore, the trajectory of weights for these year-classes appears to be following the line described by mean(w) - 2sd(w). Therefore, in this approach the weights-at-age for the 1999 and 200 year-classes are assumed to continue along this line. Values for other year-classes are given by a five-year average calculated without the 1999 and 2000 year-classes.

#### Slow-growing 1999 year-class for landings only

As above, but with the modification applied to total (catch) and landings weights only. Discard and bycatch weights are unaffected. This was the option taken by the WG.

#### **Regression approach**

The problem with the aforementioned approach (as used by the WG) is that the estimates of mean weights at age are uncertain, and this uncertainty increases with age primarily due to decreasing samples at older ages. The use of two standard deviations less than the mean incorporates natural variability in mean weight-atage, but also incorporates age-dependent sampling error (Figure 3). Furthermore, Figure 3 shows that the distributions of mean weights around the mean are skewed for older ages (6, 7, 8 and 9) with the more extreme values tending to be in the upper tail of the distributions, thus the mean weights at 2 standard deviations less that the mean actually goes below the extent of the data for most ages 6 and older. In other words: using a symmetrical interval method for obtaining the lower limit of variability in mean observed weight, reduces the postulated mean weight further below the mean than the observed data would suggest.

*Growth of the 1999 year-class to age* 7. In order to more appropriately model the growth in the 1999 year-class, a statistical approach was taken based on regressing weight at age 7 against various covariates. Several models were investigated, varying the time-span over which the regression was fitted (the full time series, i.e. the 1963-1997 cohorts, the most recent 10 cohorts and the most recent 3 cohorts), incorporating weights for age 4 and incorporating a linear trend in mean weight with time. It was found that:

- the full time series was required to get a significant regression;
- weights at age 4 were not significant for estimating age;
- there was marginal evidence for including a linear trend with time (Table 2).

The two models considered further are as follows: regressing age 7 against age 5 with and without a linear trend with time. We tested the two models by cross-validation: refitting the models using the data for the 1963 to 1994 cohorts; predicting weights at age 7 for the 1995 to 1997 cohorts; and comparing predictions with estimates based on market sampling data. Figure 4 shows the predictions for the model without a linear trend with time and Figure 5 shows the predictions for the model with a linear trend with time. The coloured dashed lines show the estimated mean weight at age trajectories for the 1995 to 1997 cohorts. It can be seen that the model not incorporating a trend with time results in predictions that are not validated by the data. By incorporating a time trend all estimates are within 2 standard errors of the predictions. The model using a time trend seems the most appropriate. The output for the model fit of age 7 against age 5 and a linear trend with time is given in Table 3.

Growth of the 1999 year-class to age 6. The 1999 year-class is known to be slow growing and even though the model includes weight at age 5 there may be concern that a general growth model derived from all years may not capture the growth of this yearclass acceptably. To investigate this, a further methodological check is to apply the same statistical modelling method to predict weight at age 6 from weight at age 5 and to compare it to survey estimated mean weight at age 6 from surveys conducted in the intermediate year (2005). Table 4 shows the model regression to be significant and similar to that for age 7. Figure 6 shows the prediction for age 6, with error bars representing 2 standard errors. The 1999 year class is shown in red and the survey derived estimates of mean weight at age are plotted as red circles with bars representing sample variation. The survey derived estimates lies within 2 standard errors of the modelled prediction. The WG projection to age 6 was very similar.

*Conclusion.* The regression approach uses fitted linear models to forecast the mean weight of the 1999 year-class for ages 6 and 7, based on historical relationships between weights at ages 5 and 6, and ages 5 and 7. The combination of the validation of forward prediction using the 3-year truncated data set for three yearclasses to age 7, and the special case of validated forward prediction to age 6 for the 1999 yearclass, provides very good evidence that the modelling approach is reliable. The method is soundly based and uses all the data dealing with an apparent general reduction in growth rates by including trend. This method is not significantly different from the quite reasonable but rather arbitrary method used by the ICES WG but is thought to be a better point estimate as it has a formal statistical basis including prediction error bars. The point estimate growth of the

1999 yearclass using this method is illustrated in Figure 7. The weights at ages 6 and 7 are 0.535 kg and 0.845 kg, respectively.

#### Survey weights-at-age

The mean weights-at-age used in the assessment, and therefore the forecast, are based on market-sampled length data, converted to weights using fixed weightlength relationships. To investigate whether this approach had led to bias in weights, and especially to determine if the perception of slow growth of the 1999 year-class was artefactual, weights measured on the first and third quarter Scottish groundfish surveys were analysed (Figure 8). As expected, the Q3 weights are greater than the Q1 weights, but allowing for this, it is clear that the surveymeasured weights are in fact very similar to those used in the assessment WG. Therefore it is unlikely that the data measurement and collation procedure used in the WG has skewed perceptions of growth.

# Industrial bycatch

The WG forecasts for 2006 and 2007 included a continued industrial-bycatch component in the catch. ICES advice for the small-mesh fisheries for reduction (targeting sandeel and Norway pout) is that these should remain closed unless there is strong evidence of an incoming year-class large enough to increase SSB above the precautionary limit by 2007. It would seem reasonable to argue that, on the balance of probability, this is unlikely to happen, in which case there would be no industrial bycatch of haddock. The spreadsheet implementation allows for the possibility of zero bycatch F from 2006 onwards.

# Sensitivity

Table 4 indicates the sensitivity of the forecast approach to input parameters. Both landings in 2006 and SSB in 2007 are sensitive to choices made for *status quo F* and mean weights-at-age. The maximum landings forecast for 2006 that can be obtained is 58 kt, but this uses possibly unrealistic assumptions about mean weights (i.e. that the 1999 year-class is not slow-growing). The configuration used by the WG leads to a relatively low landings forecast.

# Summary and conclusions

In this paper the assumptions and methods used to produce the ICES forecast for North Sea haddock have been closely examined. Small errors have been corrected, and methods modified where necessary to increase scientific justifiability. The outcome is a spreadsheet model which can be used to explore the sensitivity of the choices made in the forecast, and which can also form the basis of new advice if need be.

Table 5 summarises the forecast output for **one** particular configuration of the spreadsheet: recruitment (30 billion), weights (regression approach), *status quo F* (3-year scaled mean adjusted for 99 year-class, 2nd approach), no industrial bycatch. This is presented here as one of many possible configurations, and is not necessarily being proposed as a final forecast. However, it is a useful test case to highlight the issue of what mean F is being referred to in management plans. Furthermore, we are of the opinion that this is likely to be the most appropriate configuration. It is similar to the accepted WG forecast, except for the weights for the 1999 year-class at ages 6 and 7 (which are now estimated on a statistically sound basis), the use of a high plus-group (which avoids problems as the 1999 year-class enters the previously-used 7+ group), and the zero industrial bycatch (which seems reasonable given current ICES advice).

The notional management plan F is 0.3, and this is to be measured over an "appropriate range" of ages. This raises the question of what an appropriate age range is for this stock. The mean over ages 2–4 does not encompass the age which is contributing the great majority of the fishery. A mean over ages 2–8 does, but is biased by estimated F on younger ages. An alternative is to calculate a weighted mean over ages 2–8, where the weights used are the estimated abundances at age. These values for 2006 are listed in Table 5 (for this particular configuration). Here we can see that a notional *status quo F* of 0.335 in 2005 (measured over ages 2–4) translates to an F in 2006 of 0.240 (weighted-mean over ages 2–8), which is actually well below the F called for in the management plan. It could be argued that this is a more pertinent approach, and has a precedent in the way Norwegian spring-spawning herring is managed.

Rationale	HumanCons 2006	Basis	F 2006	Fmult (2006)	Catches 2006	Disc 2006	Industrial bycatch 2006	SSB 2007
Zero catch	0	F=0	0.00	0.00	0	0	7.8	294.7
Status quo	41.6	Fsq	0.32	1.00	63.3	21.7	7.6	238.4
High long- term yield	27.3	F(long-term yield)	0.20	0.63	41.4	14.0	7.7	257.7
Agreed management plan	39.4	F(management plan)	0.30	0.95	60.0	20.6	7.6	240.0
Precautionary limits	10.0	F(prec limits) * 0.1	0.07	0.22	15.1	5.0	7.8	281.2
	24.8	F(prec limits) * 0.25	0.18	0.55	37.4	12.7	7.7	261.2
	45.4	F(prec limits) * 0.5	0.35	1.09	69.3	23.9	7.6	233.1
	64.6	F(prec limits) * 0.75	0.53	1.64	99.5	35.0	7.5	207.3
	73.9	F(prec limits) * 0.90	0.63	1.97	114.7	40.8	7.4	194.7
	80.0	F(prec limits)	0.70	2.19	124.7	44.7	7.4	186.6
	85.6	F(prec limits) * 1.1	0.77	2.41	134.1	48.5	7.3	179.1
	93.6	F(prec limits) * 1.25	0.88	2.73	147.8	54.3	7.2	168.5

Basis: F(2005) =scaled mean F (2002-2004). F (ages 2-5) = 0.32, SSB(2006)=232, HC landings (2005) =51, Discards(2005) =13, Industrial bycatch (2005) =5.

Table 1. ACFM catch opt	on table for	· North Sea	haddock
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Response: age.7

 Terms Resid.
 Df
 RSS
 Test Df
 Sum of Sq
 F Value
 Pr(F)

 1
 age.5
 33
 1.606891
 32
 1.429356
 +year
 1
 0.1775357
 3.974619
 0.05477296

**Table 2.** Analysis of Variance Table testing the significance of incorporating a time trend.

Call: lm(formula = age.6 ~ age.5 + year, data = wk.data) Residuals: ЗQ 1Q Median Min Max -0.2292 -0.06287 0.008262 0.06145 0.1941 Coefficients: Value Std. Error t value Pr(>|t|) ercept) 7.2741 3.2199 2.2591 age.5 1.1447 0.1053 10.8744 year -0.0036 0.0016 -2.2429 2.2591 0.0306 (Intercept) 0.0000 -2.2429 0.0317 Residual standard error: 0.09826 on 33 degrees of freedom Multiple R-Squared: 0.8101 F-statistic: 70.41 on 2 and 33 degrees of freedom, the p-value is 1.242e-012 Correlation of Coefficients: (Intercept) age.5 age.5 -0.2445 year -0.9997 0.219

**Table 3**. Results of model fit of age 6 regressed with age 5 and year as covariates.

#### Fixed recruitment, industrial bycatch allowed

Landings 06

	Status	quo F				
Weights		. 1	2	3	4	5
	1	58	52	55	58	58
	2	45	41	43	44	45
	3	45	41	43	44	45
	4	47	43	45	47	48
SSB 07						
	Status	quo F				
Weights		1	2	3	4	5
	1	329	313	321	314	310
	2	253	239	246	242	239
	3	253	239	246	242	239
	4	253	239	246	242	239
Fixed reci	uitment,	no industrial by	catch			
Landings (	)6					
	Status	quo F				
Weights		1	2	3	4	5
	1	58	52	55	58	58
	2	45	41	43	44	45
	3	45	41	43	44	45
	4	47	43	45	47	48
SSB 07						
	Status	quo F				
Weights		1	2	3	4	5
	1	329	316	323	317	313
	2	253	242	249	245	242
	3	253	242	249	245	242
	4	253	242	249	245	242
Key	Weigh	ts				
		1 3-уе	ar mean for al	l components		
		2 Slov	v 99 & 00 for a	Il components		
		3 Slov	v 99 & 00 for la	andings, 3-year	mean for discards	and IBC
		4 Reg	ression approa	ach		
	Status	quo F				
		1 2004	4 estimates			
		2 3-ye	ar scaled mea	in adjusted for 9	9 year-class (1st a	pproach)
		3 3-ye	ar scaled mea	in adjusted for 9	9 year-class (2nd a	approach)
		4 3-ye	ar unscaled m	ean	- ·	
		5 3-ye	ar unscaled m	ean without 99	yearclass	

**Table 4.** Sensitivity of landings in 2006, and SSB in 2007, to forecast parameters. The selection used by the WG is highlighted in bold.

SUMMARY											
Basis:	F(sq) =	0.33	SSB(05) =	249	SSB(06) =	253	3 Bpa =	140			
	Landings(05) =	48	Disc(05) =	9	IBC(06) =	3	3 Blim =	100			
		F(2-4) 05	F(2-4) 06	F(2-8) 06	F(2-8) 06 Nwt	F mult	Catches 2006	Landings 2006	Disc 2006	IBC 2006	SSB 2007
Zero catch		0.000	0.000	0.000	0.000	0.000	) 0	g0	0	0	300
Status quo		0.335	0.317	0.285	0.240	1.000	0 64	45	19	0	249
High long-te	erm vield	0.200	0.189	0.171	0.143	0.598	3 39	28	11	0	268
Fsg (2-4) 20	005 = 0.3	0.300	0.284	0.256	0.215	0.897	7 58	41	17	0	254
Precautiona	ry lir F(pa) * 0.1	0.070	0.066	0.060	0.050	0.209	9 14	10	4	0	288
	F(pa) * 0.25	0.175	0.166	0.149	0.125	0.523	3 35	25	10	0	272
	F(pa) * 0.5	0.350	0.331	0.299	0.251	1.046	66	47	19	0	247
	F(pa) * 0.75	0.525	0.497	0.448	0.376	1.569	9 95	67	28	0	224
	F(pa) * 0.9	0.630	0.596	0.537	0.451	1.883	3 112	78	34	0	212
	F(pa)	0.700	0.662	0.597	0.501	2.092	2 122	85	37	. 0	204
Others	15% red. TAC	0.427	0.404	0.364	0.305	1.275	5 79	56	23	0	236
		0.100	0.095	0.085	0.072	0.299	9 20	15	6	. 0	284
		0.200	0.189	0.171	0.143	0.598	3 39	28	11	0	268
		0.300	0.284	0.256	0.215	0.897	7 58	41	17	. 0	254
		0.400	0.379	0.341	0.286	1.195	5 75	53	22	. 0	240
		0.500	0.473	0.426	0.358	1.494	4 91	64	27	. 0	227
		0.600	0.568	0.512	0.430	1.793	3 107	75	32	. 0	215
		0.700	0.662	0.597	0.501	2.092	2 122	85	37	. 0	204
		0.800	0.757	0.682	0.573	2.391	1 136	94	42	. 0	194
		0.900	0.852	0.768	0.644	2.690	) 150	103	46	; O	184
		1.000	0.946	0.853	0.716	2.988	3 162	111	51	0	175

**Table 5.** Example of forecast model output. Model settings for this output: recruitment 2005 = ~30 billion, *status quo F* = 3-year scaled mean adjusted for 99 year-class, mean weights-at-age = regression approach, no industrial bycatch after 2005.



Figure 1. Mean weights-at-age for North Sea haddock, as estimated by market and observer sampling. The solid line gives the average across all year-classes, while the dotted lines show  $\pm 2$  standard deviations of these data. The 1999 and 2000 year-classes are also shown. Source: ICES 2005.



Figure 2. Comparison between the exploitation rate on the 1999 year-class, with an average over 2002-2004 calculated without the 1999 year-class. The exploitation rate is the fishing mortality F rescaled so that the average over ages 2-4 equals 1.0.



distribution of mean weights at age

Figure 3. box plots of mean weights at age for years 1963 to 2004 with +/-2 standard deviations about the mean plotted as blue lines, the mean is plotted as a black line.



Figure 4. Predictions from the model based on age 5 only. Error bars represent +/- 2 standard errors. Plotted is the 1995 (green), 1996 (red) and 1997 (blue) year classes.



Figure 5. Predictions from the model based on age 5 only. Error bars represent +/- 2 standard errors. Plotted is the 1995 (green), 1996 (red) and 1997 (blue) year classes.

crossvalidation of regression without year effect



Figure 6. The mean weights at age for the 1999 year class, with prediction for age 6 and survey derived estimates. Survey estimates are from the quarter 1 and quarter 3 Scottish groundfish surveys (plotted in light and dark red circles, respectively). Also plotted is the mean of the mean weight at age data with dotted lines representing two standard deviations about the mean. All bars represent two standard errors.



Figure 7. Predicted mean weight at age 7 for the 1999 year class, shown with the predicted mean weight for age 6. The estimated mean weights from market data for the 1999 yearclass is plotted in red along with the mean of the mean weight at age data with dotted lines representing two standard deviations about the mean.



Figure 8. Comparison between mean weights-at-age for different year-classes, as measured by market sampling of lengths ("WGNSSK"), and the first and third quarter Scottish groundfish surveys ("Survey Q1" and "Survey Q3").

# APPENDIX 3 LIST OF STECF SUBGROUP MEETINGS SINCE APRIL PLENARY

SGRST-05-01	13-17 June 2005, Ispra,	cod recovery plan
SGRN-05-03	20-24 June 2005, Brussels,	data collection - environmental integration and move toward an ecosystem approach.
SGRN-05-01	27 June - 2 July, Brussels,	evaluation of 2004 data collection programme.
SGRST-SGFEN-05-01	4-8 July 2005, Brussels	by-catches of turtles in longline fisheries.
SGRST-05-03	11-14 July 2005, Brussels	anchovies in the Bay of Biscay
SGRST-05-01	19-21 September, Ispra,	cod-recovery plan – second meeting.
SGMOS-05-01	26-30 September, Lisbon	long-term management strategies and target reference points for bay of biscay sole, celtic cod and anglerfish.
SGECA-SGRST-05-01	3-7 October, Ispra,	bioeconomic modeling.
SGRST-05-02	17-21, October, Ispra	mixed fisheries
SGECA-SGRST-05-02	24-28 October, Brussels	stock and fleet status – economic impact of tac
ADHOC-05-03	7-9 November, Copenhagen	ad hoc WG on north sea sandeel
PLEN-05-02	7-11 November, Brussels	second STECF plenary meeting 2005